BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XLI 1909. No. 11

HANGING VALLEYS.

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INTRODUCTION.

The following notes deal with two questions involved in the problem of glacial erosion: (1) Are hanging tributary valleys a reliable indication of glacial erosion of the main valley? (2) May not hanging tributary valleys result from glacial widening of the main valley, instead of from glacial deepening? No attempt at an exhaustive treatment of the subject of glacial erosion is made, certain phases of the problem alone being considered.

In this discussion I wish to exclude from consideration those types of hanging valleys which are not definitely related to a main stream and its tributaries; as, for example, the valleys left hanging above the beach level by the rapid encroachment of the ocean waves on the chalk shores of southeast England and northwest France; or the valleys in block mountains or block plateaus of the southwestern United States, raised above the level of adjacent plains by recent up-faulting of the blocks from which the streams flow. Let us deal only with that large class of hanging valleys found in well-defined drainage basins where the tributary streams enter the main valley at points well up on the valley sides, the tributary waters cascading abruptly downward to the main stream below. We may first enquire whether, and under what conditions, the occurrence of such hanging valleys proves that the main valley has suffered glacial erosion. If we conclude that hanging valleys sometimes or always prove glacial

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erosion, it will then be pertinent to enquire whether such erosion has resulted in a mere widening of the main valley, or whether significant glacial deepening must be inferred.

The Origin of Hanging Valleys.

It has frequently been urged that hanging tributary valleys might be normally produced when the main stream deepens its valley so rapidly that the weaker branches cannot keep pace with its rapid downcutting. It has also been pointed out that the conditions necessary for the production of this type of hanging valley exist only during the youth of the main stream; that period of its life history when alone it is capable of deepening its valley rapidly. I do not believe, however, that it is sufficiently appreciated how very exceptional are hanging valleys of this type. In the first place, the youth of a main stream is a period of relatively short duration. Youth is quickly passed, and the vastly longer periods of maturity and old age are entered upon. If a land mass is uplifted slowly, the stage of youth may be elided, the cycle beginning with mature valleys. The same is true in the case of more rapid elevation of weak strata. With youth elided, the possibility of hanging valleys disappears. Furthermore, there is evidence that very early in youth, if not from the beginning of stream development, tributary streams normally cut down to accordant levels with their main trunk. We should expect, then, that the chances of finding hanging tributary valleys due to the youthful overdeepening of main streams, would be very small, except in special localities which have just experienced recent and rapid uplift.

Even in regions of very recent uplift the chances of finding hanging valleys due to the rapid deepening of the main stream are smaller than might at first seem to be the case. The lower course of the main stream is first entrenched, and the effect of the revival of erosion is transmitted up the main stream and up the tributaries. When the midstream tributaries have received news of the revival, and have been left hanging above the main stream, the downstream tributaries will have adjusted themselves to the new conditions; or the falls produced by the hanging effect will have migrated up the tributaries some distance so that they will no longer be typical hanging valleys. Only in certain parts of the rejuvenating drainage system could we expect to find hanging valleys of the type here discussed.

If an uplift be accompanied by very pronounced tilting, in such a direction that the main stream is accelerated throughout its course, while the tributaries on either side are not so effected, hanging

valleys might be produced simultaneously along the entire length of the main stream. If the tilt were at an oblique angle to the course of the main stream, the main stream and the tributaries on one side would be accelerated, while the tributaries on the other side would be retarded. Hanging valleys along one side of the main stream would result. There is a greater chance of oblique tilting than of tilting exactly in the direction of the main stream's course. And since the peculiar feature of hanging valleys along one side only of a stream has not been reported, it is reasonable to suppose that hanging valleys due to the acceleration of the main stream by tilting are of rare occurrence.

I have elsewhere reported the local occurrence of what may be termed hanging valleys produced by the rapid entrenching of a main stream after capture.* When a drainage system is maturely adjusted in all its parts, the sudden introduction of an additional volume of water by capture may cause the deepening of the course along which the captured waters flow; while tributaries to that course are temporarily left in a hanging position. In the case of the capture of the Upper Chattahoochee by the Savannah River, even small tributaries have adjusted themselves to the new conditions; and it is only the very smallest branches that have failed to cut down to the new levels of the main stream. Even they have worn their falls back a short distance into the main valley wall, and no one familiar with their relations and with the hanging valleys characteristic of glaciated regions, would for a moment confuse the two. Bowman has reported the occurrence of hanging valleys due to normal stream erosion in the eastern Andes, where both the distribution and the very existence of the hanging valleys depend on an unusually favourable combination of rapid, recent, and extensive uplift, and deep dissection in rocks having strong and sudden alternations of hard and soft belts. In comparing the hanging valleys of the Andes with those of glaciated regions, he writes: "No one should misinterpret these two kinds of valleys merely because they have this in common, that they are hanging with respect to the master stream. In the assemblage of detailed characters no other likeness between the two types is discernible."† Hanging valleys of any size due to normal stream erosion are of rare occurrence, and may be recognized by their associated features.

So rare, indeed, is the theoretical probability of finding hanging valleys due to normal stream erosion, that we should be greatly sur-

* Drainage modifications in the Tallulah District, Georgia. *Proc.* Bost. Soc. Nat. Hist., 33, 211–248, 1907.

† Unpublished manuscript.

prised were they reported in large numbers from regions where streams alone were the principal erosive agents. That they have not been so reported is certain. That they are not common features in such regions it is reasonable to conclude; for hanging valleys have been much discussed and described in late years; and if they were abundant in non-glaciated regions, surely those who do not believe in the efficacy of glacial erosion would not continue to make the mistake of citing as examples of stream-produced hanging valleys those which occur in glaciated districts. That they do not make an effective appeal to the evidence of hanging valleys in non-glaciated regions must be because hanging valleys are rare in such regions.

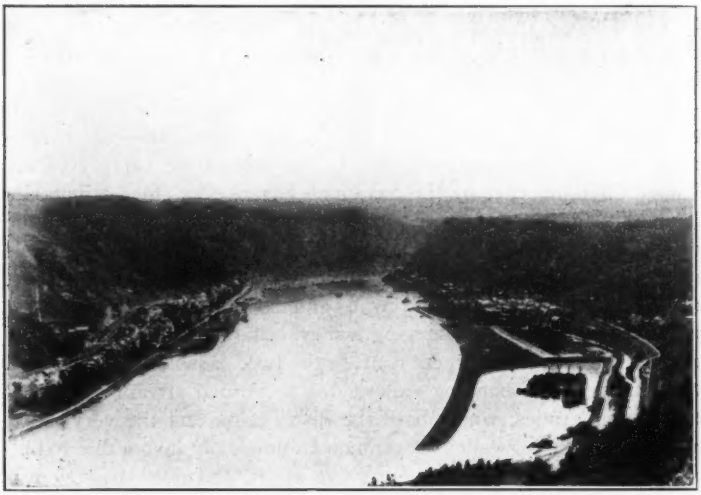

FIG. 1—GORGE OF THE RHINE AT ST. GOAR.

I have made some search for hanging tributary valleys in regions where the possibility of glacial origin could be safely eliminated. The result has been to impress upon me a fuller realization of the remarkable ease with which even small and insignificant tributaries maintain accordant junctions with the down-cutting main streams into which they empty. In a stream so young and vigorous as the Colorado River in its cañon, small tributary cañons which seldom have water in them open into the main cañon essentially at grade: a feature remarked upon by other observers. Even in the western edge of the Uinkaret plateau block, so recently uplifted by renewed movement along part of the Hurricane fault that the face of the

scarp has been but little modified, a short wet-weather ravine just south of the Virgin River, carrying water only after heavy rains, has entrenched itself until it now debouches on the lower block at grade.

The gorge of the Rhine through the upland peneplain of western Germany is a most favourable place for the occurrence of hanging valleys, if such valleys are at all characteristic of rejuvenated streams. The Rhine is a large trunk stream, joined by many tributaries on its way through the uplands. Somewhat depressed below the remarkably even surface of the uplands is a broad, shallow valley, so faintly marked in places as to be almost imperceptible, but floored with river gravels and silts. Into the bottom of this

FIG. 2—JUNCTION OF WELLMICHER BACH WITH THE RHINE.

older valley the present gorge of the Rhine is sharply entrenched. Figure 1 shows the even skyline of the gently rolling uplands, a portion of the old valley floor on the upland at the right, and the gorge at St. Goar. The youthful character of the present Rhine is apparent. As a rule the river occupies nearly all of the bottom of the gorge. The walls are so steep that it is difficult to ascend them, except at certain favourable localities. On these difficultly accessible slopes stand the ruins of the ancient castles, which from commanding points dominate the river. The northern and eastern sides of the gorge, because of their good exposure to the sun's rays, have been utilized for vineyards, which produce some of the most highly prized

white wines in the world. The great value of these vineyards and the steepness of the gorge walls are both shown by the intricate series of terraces constructed to keep the soil from descending into the river. The sides of the gorge are in places traversed by a network of stone walls and arches which are carefully preserved. That the river is not yet completely graded is shown by the swift current and occasional rapids which render inexpedient the construction of piers at a few of the towns, and require landings to be made in small boats.

Into a large and vigorous main stream of such youthful characteristics, cut in rock so resistant that the gorge walls rise boldly in

FIG. 3—GORGE OF THE RHINE BELOW ST. GOAR.

steep slopes, how do the tributary streams enter? Have they been able to keep pace with the downcutting of the main stream? Or do they possess hanging valleys? Figure 2 is a typical view of the junction of a small tributary stream with the main river. It shows the mouth of Wellmicher Bach at the town of Wellmich; the latter being located at this point partly because the accordant floor of the side valley affords a favorable space for the growth of the town. The steepness of the valley walls is suggested by the terraced vineyards.

Wellmicher Bach is a small stream, heading about five miles back in the uplands; yet it enters the Rhine with an accordant junction,

and not from a hanging valley. In the foreground of Figure 3 is seen a portion of the northwestern side of the Grundelbachthal, a tributary valley about five miles in length, which also enters the Rhine at grade. Opposite Wellmich is a ravine perhaps a mile long; and even this small ravine has an accordant junction with the main gorge. That the portion of the Rhine into which these streams empty is characteristically youthful is shown by Figure 3. These examples are typical of the relations existing between the Rhine and its tributaries throughout the gorge. The gradients of the shorter and weaker tributaries may be relatively steep. Occasional small branches may possibly be found which are sufficiently oversteepened near their mouths to be called hanging valleys in a broad sense of the term. But it is unquestionably true that even small and weak tributaries of the Rhine enter the main gorge at accordant levels, and that typical hanging valleys are absent.

It would seem that a correct answer to the first of the two questions here dealt with must be to the following effect; Hanging tributary valleys may be produced independently of glacial erosion; but hanging valleys of this type are of rare occurrence. Hence the abundant examples of hanging valleys found in glaciated regions must be in some manner related to the process of glaciation. The frequent occurrence of hanging tributary valleys in glaciated districts, and their rarity in non-glaciated districts, is a most significant relation, and one which those who doubt the glacial origin of these valleys have never explained. To say that these valleys may have been produced in some peculiar manner as yet unknown to us is not permissible. The science of physiography has reached a point where the appeal to ignorance will no longer carry much weight. That glaciers must produce hanging tributary valleys, providing they are capable of eroding their channels, has been repeatedly shown. That hanging tributary valleys are abundant in glaciated regions and not elsewhere, affords a presumption in favor of glacial erosion so strong that a constructive argument to account for this peculiar relation, instead of an appeal to ignorance, may reasonably be asked of one who proposes to reject the theory of ice erosion.

Glacial Deepening vs. Glacial Widening.

Granting that hanging tributary valleys are generally to be regarded as an indication of glacial erosion, I wish next to consider whether "over-deepening" of the main valley is to be inferred when the tributary valleys have a hanging position; or whether mere

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widening of the main valley may not account for all the phenomena observed.

It has been suggested that where tributary streams enter the main stream at grade, glacial widening of the main valley alone may cause the tributaries to have hanging valleys, as shown in Figure 4. It is clear from the figure that such an origin for hanging valleys is possible, whenever the conditions implied in the figure are fulfilled. It should be noted that the figure considers only such tributaries as are short and very steep. In considering hanging valleys, however, we do not deal with steep ravine notches in the valley walls, but with well-formed tributary valleys several miles in length. Figure 5 represents an ideal profile of a side stream 2 or 3 miles in length and of rather marked gradient, entering the cross-section of a very steep-sided main valley (slope of sides 45°). The broken lines show the condition after glacial widening of such a valley, without glacial deepening.

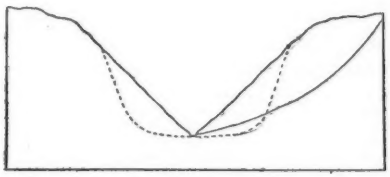

FIG. 4.

It will appear from Figure 5 that where tributary streams are long enough and mature enough to have a gentle gradient, the opportunity for the development of hanging valleys by widening alone is very slight. The rock bottom of a glacial trough is not characteristically

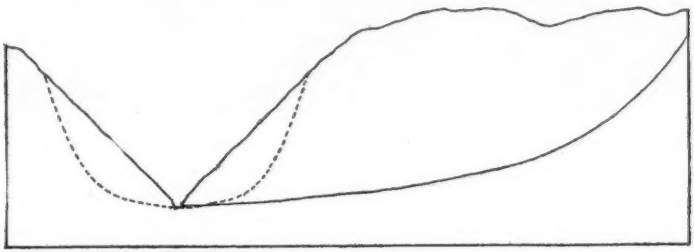

FIG. 5.

flat, but gently rounded with angle of slope increasing toward the sides. It is probable that the slope of the trough floor toward its median line is in most cases greater than the gradient of tributary streams of any length, so that the lower portion of the tributary stream profile would for the most part lie below the curve of the trough bottom (see Figure 5). For this reason it is difficult to see

how glacial widening alone could possibly cause a normally graded tributary stream, several miles in length, to hang noticeably above the main stream. On theoretical grounds, therefore, we are led to conclude that glacial over-deepening is a prominent factor in the production of hanging valleys.

It is possible, by careful fieldwork, to test the validity of the above conclusion. I have made an attempt to do this, on a small scale, and the results are given below. Before considering these results, it is desirable to call attention to certain points which must be kept in mind when making an attempt of this kind.

Let us imagine a tributary stream, AB, Fig. 6, emptying into a glaciated main valley WXY, at the point B. Let BC represent the former continuation of AB into the preglacial main valley WCY. The actual amount of glacial over-deepening is then CX. But inas-

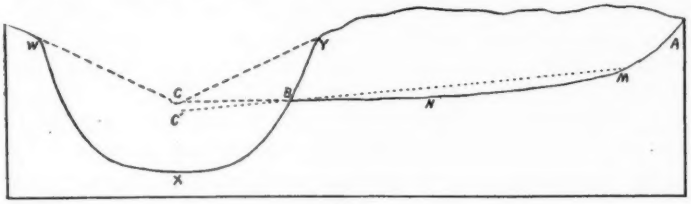

FIG. 6.

much as WCY and BC are preglacial features, totally destroyed by glaciation, it is manifest that we cannot determine the value of CX with absolute accuracy. The whole question of determining the amount of glacial overdeepening, CX, depends on our ability to restore BC correctly.

It is generally true that a stream decreases in gradient toward its mouth. That is, the profile of equilibrium is a curve steepest in its upper part, and approaching horizontality in its lower part. AM is steeper than MN, MN steeper than NB, and NB steeper than BC. On this basis we could reconstruct BC on a somewhat gentler slope than the lower portion of the stream still remaining, and so arrive at a fairly close approximation to the value CX. The danger in this method lies in the possibility that AB is not a well-graded stream, but has very different slopes in different parts of its course. NB might be an unusually flat part of the profile AC, so that BC was really steeper than NB, instead of less steep, as would be the case in a well-graded stream. The effect would be to make CX greater than it should be, or to exaggerate the amount of glacial over-deepening. The shorter and the younger the tributary stream, the

greater is the danger of falling into this error. It is manifestly important to examine a greater portion of the tributary valley than simply NB.

In order to be on the safe side, we may omit all consideration of the normal variations in the gradient of the valley downstream from some point near its headward portion, as M, Figure 6, and consider the dotted line MB as the average gradient of the tributary valley, and the line BC′ as the former continuation of this valley. As will appear from the figure, this method will be pretty sure to lead to an underestimate of the extent of glacial overdeepening: there will be little or no chance for an overestimate, except under the improbable conditions noted in the next paragraph. In case the tributary valley has a very uniform slope from near its head to its mouth, the lines MNBC and MBC′ coincide, and the quantity CC′ becomes zero.

Three objections might be urged against this method. It might be said that in preglacial time the line BC′ did not continue as projected, but took a sharp bend down to X; and that if we admit this possibility, there has been no glacial deepening after all. This, in effect, would be to argue the existence, in preglacial time, of an abundance of hanging valleys due to normal stream erosion. For it is plain that by this interpretation AB is a hanging valley, or a hanging valley but slightly cut back in its lower course. That numerous hanging valleys due to normal stream erosion are extremely improbable has already been shown. Furthermore, the advocate of such an interpretation would have to explain the remarkable abundance of preglacial hanging valleys in regions later to be glaciated, and their absence elsewhere. This last statement applies with equal force to the suggestion that preglacial entrenching of the main stream may have caused each tributary stream to become oversteepened in its lower course enough to give, not an abrupt drop downward to X, but a gradually increasing slope (a profile convex upward) leading down to X. While such oversteepening might occur locally, in the case of weak tributaries, it cannot be admitted as a characteristic feature of preglacial topography, for reasons discussed in the first part of this paper.

In the second place, it might be urged that the centre of the preglacial valley was not in line with the centre of the present glacial trough, but well to one side of it. If the trough were very broad and flat bottomed, as in Figure 7, it is evident that the method here proposed might lead one to calculate glacial overdeepening amounting to CX whereas there had been no overdeepening at all, but only widening. It should be noted, however, that while this objection might be

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urged, under the special conditions represented in Figure 7, against conclusions derived from the study of a single hanging tributary valley, the objection is ruled out when hanging valleys occur on both sides of the main trough. This may be seen by imagining another hanging valley DE, similar to NB, to enter the opposite side of the

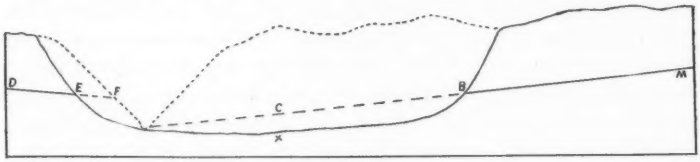


FIG. 7.

glacial trough. Its prolongation, EF, shows that it would be a hanging valley due to normal stream erosion, an improbability already fully considered. It may be further noted that in most of the cases observed by the writer, the prolongation of the tributary valley would not touch the floor of the main trough even at the farther side of the trough, but would strike some distance up on the opposite wall. A quick qualitative way to determine this point is as follows: If from no point on the floor of the main valley the floor of the tributary valley is visible; or if from a point some distance back in the hanging valley no part of the main valley floor is visible, there has been glacial overdeepening of the main valley. It should be noted that the converse propositions are by no means necessarily true. A valley deepened by glacial erosion might be so widened that the farther side of the main valley floor might be seen from well back within the hanging valley; or the floor of the hanging valley might be visible from the farther side of the main valley floor.

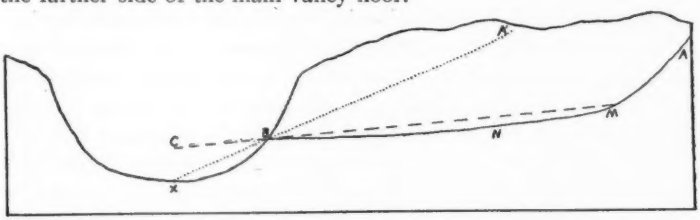


FIG. 8.

A third objection to the method here employed for determining glacial overdeepening might be to the effect that glaciation had so changed the tributary valley that it no longer had so steep a slope as in preglacial times. For example in Figure 8, whereas we calculate the glacial overdeepening of the main valley as CX on the basis of an

average slope of MBC in the tributary valley, it might be urged that the preglacial tributary valley had a slope A′BX, and that there had accordingly been no glacial deepening of the main valley, but simple valley widening. This is an objection which can only be urged by a believer in profound glacial erosion. For since the present tributary valley has the curve ANB, glacial erosion must have deepened this valley by the amount A′N. Postglacial stream erosion could not be appealed to, for such erosion has not been able even to reduce the hanging effect at B. Furthermore, the tributary valleys often show glacial markings and glacial deposits over their walls and floors, but little effected by postglacial erosion. Small notches are sometimes found in the lips and floors of glaciated hanging valleys, and show that postglacial erosion has been very limited in amount. As shown in Figure 8, the lip, B, of the hanging valley is a fulcrum point, nearer to the center of the main valley than to the headward portion of the hanging valley. It follows, that in order to get rid of a moderate amount of glacial deepening in the main valley, we must admit an enormously greater amount of glacial deepening in the hanging valley; and must further suppose that this glacial deepening was restricted to the upper portion of the tributary valley, in order that the elevation of B should not be lowered; and that the main valley was glacially *widened* to give the typical hanging effect. That such a special combination of circumstances was an important factor in producing the numerous hanging valleys of glaciated regions must be doubted. It is quite possible that relatively more effective erosion in the upper parts of some tributary valleys, especially during the waning of the glacial epoch, may have resulted in decreasing the average slope of the tributary valleys, and that the quantity of overdeepening figured on the basis of the method here described might be overestimated in such cases. But it appears from Figure 8 that a considerable amount of overdeepening of the tributary under these conditions would introduce a relatively small error into the calculation of overdeepening in the main valley. In tributary valleys a number of miles in length, the possibility of overestimate from this source must be very small. It should be possible in some cases, by examining the relations of the hanging valley to its own small branches, to determine with approximate accuracy the amount of overdeepening in its several parts.

While a considerable overdeepening of the headward portion of a hanging tributary valley has a relatively small effect on the calculation of the glacial overdeepening of the main valley, any overdeepening of the lower course of a hanging valley introduces an

appreciable error into such a calculation. If the mouth of a hanging valley has been deepened 200 feet below its preglacial level, the calculated overdeepening of the main valley, C′X in Figure 6, will be about 200 feet too small. I am convinced that wherever the mouth of a hanging valley has been materially altered to the typical glacial trough form, we must infer a greater or less amount of glacial deepening at that point, and must take it into account when estimating the overdeepening of the main valley. Furthermore, the main valley trough is apt to be floored with stream deposits or lake waters, or both; and the true depth of the trough thus concealed.

It is evident, from all that has been said, that the total amount of glacial overdeepening, as determined from a study of the relations of the main and tributary valleys, is equal to (1) the definitely calculated amount C′X, (Figure 6) plus (2) the indeterminate amount CC′ due to the too great slope figured for the prolonged lower course BC′, of the tributary stream, plus (3) the depth of glacial erosion in the lower course of the tributary valley, plus (4) the depth of the water or waste on the floor of the main valley, minus (5) an uncertain but probably negligible amount due to a decrease in slope of the tributary valley resulting from excessive glacial erosion in the headward portion of the valley. It need hardly be added that in making these calculations, the observer must sharply discriminate between the preglacial elements in the topography, the slopes due to glacial erosion, and the narrow notches cut by postglacial erosion in the lips and floors of glaciated valleys.

Glaciated Valleys in Europe.

With the above principles in mind I have examined some of the hanging valleys in the glaciated districts of France, Switzerland, northern Italy, the English Lake District, and the Highlands of Scotland. It would be more accurate to say that some of the valleys were examined with only some of the principles in mind; for the details above discussed were in part elaborated during the progress of field observation and study. It was found that properly to evaluate all of the factors in the problem for most of the hanging valleys observed, would require more elaborate field surveying than I was able to give. The amount of glacial overdeepening of the main valley had often to be roughly estimated; but as to the fact of appreciable overdeepening in most cases, I could entertain no doubt. The following three examples of overdeepened main valleys will serve to illustrate the principles discussed in this paper, which will, I hope, be

further elaborated and tested by some who can give more time to the problem than it was possible for me to give.

The valley of the Upper Engadine in Switzerland, extending northeastward from Maloggia Pass, offers abundant evidence of its former occupation by ice. The "trough" form is not so symmetrical as in many glaciated valleys, but is distinctly present. A series of small lakes occupies the bottom of the trough between Maloggia and St. Moritz, and while these lakes have been referred to as typical illustrations of the lakes sometimes associated with river capture, there is reason to believe that they are in no way related to the drainage modifications which have undoubtedly occurred near Maloggia Pass, but are to be classed with the lakes found so abundantly in glacial troughs in all regions of Alpine glaciation. Three of these lakes, the Silser See, the Silvaplaner See, and the See von Campfer, formerly constituted a single body of water. The two former have been separated by the growth of the Sils delta, deposited mainly by a stream draining the hanging Val Fex. The Silvaplaner See and the See von Campfer have been separated by the all but complete junction of the Silvaplana and Surley deltas, built out from hanging valleys on opposite sides of the main trough. The Silser See is in the process of being divided into two parts by the Isola delta, which is being deposited by a stream issuing from the hanging Val Fedoz. We thus find in the Upper Engadine three different stages of a process carried to completion in the oft-cited Interlaken case. The physiographic relations of the great Shantung peninsula, in China, are here repeated on a miniature scale, small rocky islands, formerly out in the midst of the lake, being now tied to the main shore by the growth of three of the deltas. Every delta has determined the location of a village.

The Val Fedoz (Figure 9) is a fairly simple type of the hanging valleys of this region. The stream which drains it heads at the foot of the Fedoz glacier a few miles to the south, and flows northward with fairly uniform slope until near the hanging junction with the main trough. Here a narrow postglacial gorge has been cut, in which the stream cascades down through the lip of its hanging valley to the level of the Silser See, into which it is building the Isola delta. A zigzag road leads from Isola village up into the hanging valley. Standing on the opposite side of the main trough, it is impossible to see the floor of the Val Fedoz, so great has been the deepening of the main trough. That the Val Fedoz has itself been profoundly glaciated is evident from its beautiful glacial trough form.

The Swiss contour maps give the surface level of the Silser See

as 1,796 meters; the lip of the Val Fedoz is about 150 meters higher; for 3,800 meters south of here the valley has a rather uniform slope up to the 2,070-meter contour line. If we plot these points to natural scale, and project the slope of the Val Fedoz out to the central area of the main valley, the projected line falls about 120 meters above the level of the Silser See. There is a strong probability that the Val Fedoz has been considerably deepened throughout its length in the course of the profound glaciation which it has suffered. The total amount of glacial overdeepening of the main valley, then, is 400 feet + 200 feet, the depth of the Silser See + the depth of the sediments accumulated in the bottom of the lake, + the amount of glacial deepening of the Val Fedoz,—a few feet correction to be

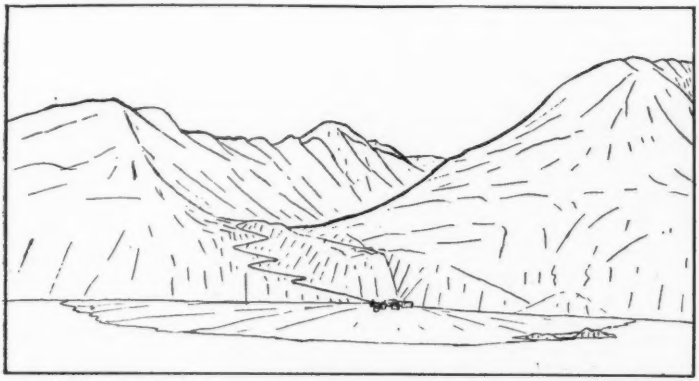


FIG. 9—HANGING VAL FEDOZ, AND THE ISOLA DELTA. (DRAWN FROM PHOTOGRAPH.)

applied if the southern end (head) of Val Fedoz has been deepened much more than the northern end. A total overdeepening of 700 feet in the main valley of the Upper Engadine due to glacial erosion, is a conservative estimate.

The remarkable hanging valleys along the Ticino above Lake Maggiore in Italian Switzerland have been described by Davis.* That the main trough of the Ticino has been profoundly overdeepened by glacial erosion is the conviction which grows upon one who endeavors to analyze the topography and to reconstruct the preglacial conditions. I can add nothing to the appreciative description of these valleys by the above cited author, except a brief account of my own attempt to get a rough quantitative statement for the amount of overdeepening in the vicinity of Biasca. After an ineffectual

* "Glacial Erosion in the Valley of the Ticino," Appalachia, 9, 136–156, 1900.

attempt to ascend the precipitous southwest wall of the main trough, high enough to look into the hanging Val Nadro, I climbed up into the lower portion of the Val d'Ambra. In this region there is distinctly shown a younger trough (Figure 10) within an older trough, both of which are probably due to glaciation. The Ambra, a stream four miles or more long, flows in a postglacial trench cut in the bottom of a glaciated tributary valley, then down a similar trench in the steeper slope of the outer trough, and finally in a sharply cut notch down the very steep side of the inner, younger trough, to the Ticino River.

Even if we reckon the overdeepening from the edge of the inner

FIG. 10—VALLEY OF THE TICINO, NEAR BIASCA.

trough alone, we find evidence of significant glacial erosion. The elevation of the main Ticino Valley in this vicinity is about 300 meters. The elevation of the rim of the inner trough, from which the Ambra drops abruptly to the level of the Ticino, is about 510 meters. 2,300 meters to the southwest the Ambra is about at the 870-meter contour line (exact position of contour line difficult to locate). On the basis of these figures, which relate to the postglacial gorge of the Ambra in the portion of its course above the rim of the inner trough, the main valley has been overdeepened 330 feet + the depth of the deposits on the floor of the trough + the

glacial deepening of the Ambra Valley + the postglacial trenching of the Ambra River. Judging by the "shoulders" (above the postglacial trench of the Ambra) on which Matra and other small villages are located, the floor of the glacial Val d'Ambra proper has an elevation of something like 900 meters. This corresponds roughly with a prominent shoulder along the main trough on which numerous villages are picturesquely situated high above the Ticino. Allowing for a steep gradient in the glaciated tributary, the total overdeepening of the outer and inner troughs combined, can scarcely be less than 1,200 feet + the depth of the deposits on the bottom of the inner trough + the amount of glacial overdeepening of the Val d'Ambra.

FIG. 11—HEAD OF MONT DORE VALLEY, CENTRAL FRANCE.

Above the upland peneplain of central France, generally called the Central Plateau, rises the dissected volcano of Mont Dore. One of the radial consequent valleys which resulted from the dissection of the volcano is drained by the northward-flowing Dordogne River, and in this valley is located the picturesque little town of Mont Dore, famous for its mineral springs and baths. The Mont Dore valley, as we may call it, has been profoundly modified by Alpine glaciation. The southern part of the valley (Figure 11) is open and its sides dissected into the sharp angular peaks so frequently found in the gathering grounds of glaciers. Toward the north the valley narrows and assumes the remarkably smooth trough-like form common to well

XUM

developed glacial channels (Figure 12). Just south of Mont Dore a small stream heading a little over a mile to the southeast of its junction with the Dordogne, falls over a hard layer of volcanic rock into the Mont Dore valley, forming La Grande Cascade. It is a small hanging tributary entering the main Mont Dore trough with a strikingly discordant junction.

The floor of the Mont Dore trough has an elevation of 1,050 meters. A point near the head of one branch of the tributary valley has an elevation of 1,414 meters. No figure is given for the crest of the cataract, but judging by other data for nearby points the crest of the cataract, or the mouth of the hanging valleys, has an elevation

FIG. 12—GLACIAL TROUGH AT MONT DORE. (PHOTO. TAKEN FROM LIP OF HANGING VALLEY.)

probably not under 1,340 meters, and certainly not under 1,300 meters. On the basis of the first figure, the directly calculated overdeepening of the main trough amounts to 740 feet. On the basis of the second figure the directly calculated overdeepening amounts to 500 feet. The hanging valley has been little if at all modified by glacial action, so there is no correction to apply for glacial overdeepening along its course. But the lower part of its remaining course is noticeably of a more gentle gradient than the part next upstream, so it seems possible that some correction must be made on account of a calculated average slope of too great an inclina-

tion. On the other hand, it is possible that the gentle gradient at this point is due to the hard rock layer over which the stream is flowing, and that the former continuation of the tributary was not so flat. Accordingly, the overdeepening of the Mont Dore valley, due to glacial erosion, amounts to 740 feet (or 500 feet) + the depth of deposits on the floor of the valley + (?) an uncertain but perhaps significant amount, correction applied for excessive gradient assumed in calculation. That the total overdeepening may amount to 900 feet is quite possible.

One value of the method above outlined lies in the fact that it directs attention specifically to the several variable elements involved in the calculation of glacial erosion, and calls for careful evaluation of each. That the method is more reliable than the projection of remnants of the V-shaped valleys above the glacial trough, where these remain, will be evident from a consideration of Figure 13. Imagine the gorge of the Rhine near St. Goar (Figure 1), with its accordant tributary valleys (Figure 13, solid lines), to be markedly overdeepened by glacial erosion. The projections of the remnants of the old valley walls touch the bottom of the glacial trough (Figure 13, dotted lines) and indicate that there has been no glacial deepening. A study of the hanging valleys would prove the fact of deepening, and gave an approximate idea as to its amount. Further objections to the reconstruction of preglacial valleys on the basis of a study of the higher slopes, are found in the variableness of those slopes and in the possibility of their indeterminate modification by unusually high level glaciation.

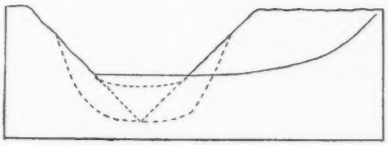


FIG. 13.

In the European illustrations given above, careful field work would enable one to supply some or all of the unknown quantities, such as the depth of alluvial deposits on trough floors, the relative amount of glacial deepening in the upper and lower courses of hanging valleys, etc., and thus to determine within fairly narrow limits the actual amount of overdeepening due to glacial erosion of stream formed valleys.

THE VOLCANO KILAUEA.

BY

C. H. HITCHCOCK,
Dartmouth College.

This volcano has recently passed through an interesting period of activity, part of which has been under my observation. Before presenting a sketch of these latest phases, I will briefly notice its history, condensing the results of a careful study.

Writers have usually contented themselves with a description of what has happened since the islands have been visited by people of European extraction, about 1820. I have found that the traditions of the natives are capable of giving reliable information about the nature and approximate dates of eruptions for eighteen centuries. Historians have discovered the date when the Hawaiians and Maories separated, because both these races preserved lists of their kings who were the same persons, anterior to the separation. The first emigration to Hawaii was under Wakea in the year 140 A. D. The more important emigration has the date of 1090. The traditions state that, during the entire history of the country, Kilauea has had its periods of activity with an average of one for each reign. Assuming, as is customary, one reign as equivalent to a generation, there would be three reigns and consequently three eruptions for each century, or forty-four since 140.

A few of these eruptions have been especially noted: such as a celebrated conflict between Pele and Tamapua in 1175; another with Kariwari between 1340 and 1380; others later, better characterized. They may be tabulated as follows:

Active at the time of the first immigration	140
The same at the second immigration	1090
Average of one for each reign: forty-four	to 1820
Pele's conflict with Tamapua	1175+
Pele's conflict with Kariwari	1360-1380
In the reign of Liloa	1620
In the reign of Arapai, at Kaimu	1740
Eruption west of Kapoho	1788
Keouas army destroyed	1790

Of these the eruption of 1620 seems to have been of the explosive kind, more violent than that of 1790.

Posterior to 1820 the following have been the dates of the most important discharges of lava:

DATE.		PLACE OF DISCHARGE.
1823	Between March and June	To the Southwest; reaches the sea.
1832	June 20	Subterranean.
1840	May 30	To the Northeast; reaches the sea.
1849	May	Subterranean.
1855	October	Subterranean.
1868	April 2	To the Southwest; reaches the sea.
1877	May 21	Overflow at Keanakakoi.
1879	April 21	Subterranean.
1884	Jan. 22	Submarine, off Puna.
1886	March 7	Subterranean.
1891	March 7	Subterranean.
1894	July	Subterranean.
1902	Sept. 12	Subterranean.
1908	Sept. 4	Subterranean.

I will mention three points of interest. First: What is called an eruption consists in the accumulation of melted matter, which falls away when the sustaining walls are inadequate to support the liquid. The lava may break through the side of the mountain and flow to the sea, or may reach the bottom of the ocean before the discharge, or there may be a collapse in the interior of the caldera, when the liquid will disappear to parts unknown, beneath the surface. After this collapse the fire usually returns slowly, increasing in amount till it is time for another discharge.

Second: Besides the accumulation of lava, there is an ascensive column, best seen between 1886 and 1894, when a mass of cooled lava rose bodily higher than the accompanying liquid. It was spoken of by some as a mass of rock resting upon a liquid floor, elevated a foot or less daily according to the amount of pressure exerted from beneath. This column must have had a length of several hundred feet. It is comparable with the Spine of Pelé at Martinique, preserved by its enclosure within the walls of Halemaumau, disappearing when its foundation gave way, being like a piston rod moving inside of a cylinder.

Third: Since 1823 the molten lava has attained greater altitudes just before the times of each collapse, chiefly because the cooled basalt has formed a hollow cone of less diameter, so that the same amount of fluid must rise higher in the later periods. Where at first there was an immense pit, a basaltic cone occupies the space; the caldera is slowly filling up.

The supreme event in the history of Kilauea was the presence of a lake of liquid lava at the end of the ascensive column in 1894.

This attained the altitude of 3,755 feet above the sea, 285 below the Volcano-house, with an area of 13.67 acres, as represented in Fig. 1; it is seen to have a border consisting of the cooled edges, substantial enough to keep the liquid within bounds, shaped like an inverted saucer. The molten lava came from below, just as water would fill a barrel through a pipe; and both fluids alike overflowed their receptacles. In 1896, after the lava disappeared interiorly, there was left a cylindrical opening 1,500 feet in diameter, 900 or more feet deep, which is known as Halemaumau, *the fixed, everlasting house.* From time to time this pit shows lava in its depths, accumulating and discharging without any apparent law.

What may be regarded as the beginning of the present activity commenced at the end of November, 1907; a little lava appeared at

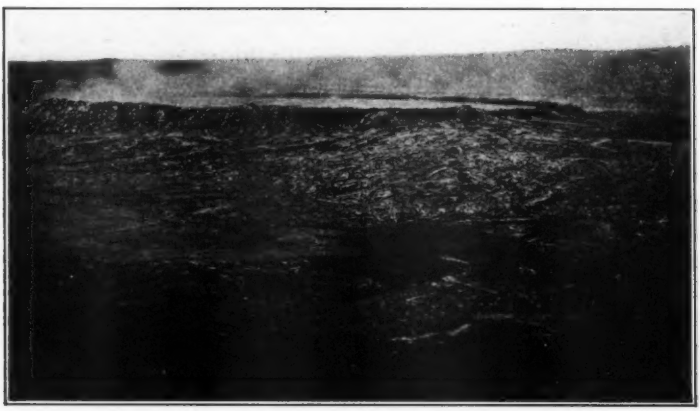


FIG. 1—KILAUEA. ERUPTION OF 1894.

the bottom of the pit after a quiet of seven months. Early in December the base was encircled by a black ledge, 450 feet down in which was a lower pit 200 feet wide, showing fire 80 feet lower. In the latter part of March, 1908, the pit was estimated to be 1,800 feet in diameter, 300 feet deep, with a spiracle in one corner spouting noisily, and occasionally blowing off its head. The *spiracle* is what early observers have called a blowhole or blowing cone, receiving its name from G. Poulett Scrope, after Italian examples.

On May 26 the pit was estimated to be 200 feet deep, and the molten lake 800 by 700 feet, with a crescent-shaped island in the middle, 75 feet long. After each outburst of gas a tremendous suction draws lava from a radius of 100 feet into a maelstrom; cakes of

lava fifteen to twenty feet in diameter turn upon their edges and disappear. Upon the north side a great spring pours lava out copiously.

On June 21, the lake is fifty per cent. larger.

On July 14, the boiling pit has filled up 25 feet in the previous fortnight.

By the middle of August the lava reached the elevation of about 150 feet below the rim, supplied from a small area upon one side called "Old Faithful." The part most remote from the fountain cooled, and thus was built up a structure like an inverted saucer; but this rim would give way and allow a stream of the lava to even up the surface. Dr. N. B. Emerson thus describes "Old Faithful":

"A jet of lava appears:—scales are sucked down around it. This swells up as one huge, rotund, white hot mass leaping high into the air for many seconds and then subsides as if there were a connection with a fire shaft deep in the earth's interior."

There are other similar jets in other quarters and near the edge. The surface becomes encrusted, lines of fire like the arms of Octopus traverse the darker areas and break up the ice into fragments, which tip over, sink, and disappear. Waves dash against the walls of the pit like surf against cliffs.

By September 4, the lava attained its highest level, about 100 feet below the rim, when a discharge took place just like the eruptions of earlier dates. The fountains ceased to play; the lake began to sink in the centre; the liquid began to pour as cataracts of fire into a chasm, like water pouring into a funnel. As the torrents drained away the sides of the pit began to crash into the lake, hundreds of tons of rock peeled off the sides, stones crunched and when heated exploded with terrifying detonations. It took two hours for this collapse to be effected. Everything that had filled the pit for nearly 1,000 feet drained away, and the next day the volcano was dead.

On the evening of September 6, a spark of fire appeared 500 feet down, the lava returned, and in about the same time required for the discharge, the pit was filled again to 150 feet below its original level. "Old Faithful" and the other jets and currents played as before. Coincident with the collapse there were earthquakes in Hilo and Puna, the most severe occurring on Sept. 5. Those who had memories of the great shocks of 1868 believed these later quakes to have been as vigorous as those of the earlier date. Great damage was done to china and earthenware, but buildings were not particularly shattered.

The lava returned to stay. The records of the fall and winter

repeat the conditions that have been already described previous to the collapse.

The conditions from December 3 to 11, as I observed them, were these: The lake was estimated to be 350 feet long and half as wide. The jagged fire-lines, as before, shattered the encrusted surface into fragments, which sank and disappeared. The action of the liquid was like that of ebullition. Near the boiling area there was a movement estimated to be as much as five miles per hour. From a hole in one of the walls a stream of lava would occasionally pour into the gulf. The spatter work reminded one of gold leaf. Pele's hair* was forming constantly. The level of the lake is variable. Three black ledges are apparent at different levels.

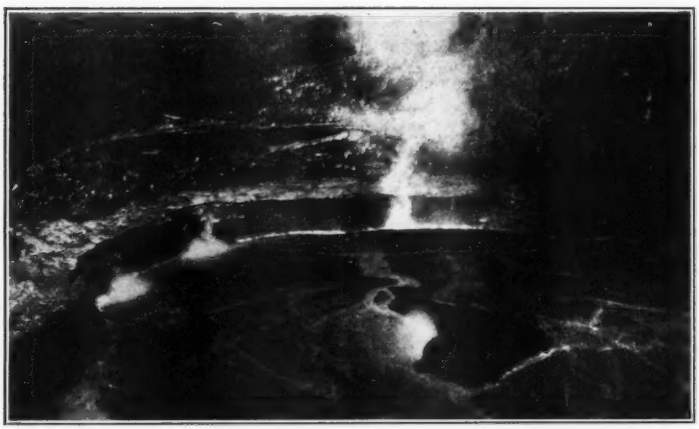


FIG. 2—KILAUEA. ERUPTION OF 1908.

Early in February Mr. E. D. Baldwin, a competent engineer, found the level of the liquid lava to have been 235 feet below the edge of the pit. And judging from the reports of visitors, the conditions did not materially change through March and April. The conditions of the last two years remind one of the eruption of 1879. For many months Halemaumau had been in an active state, and the bottom dropped out on April 21. Seven days later it was reported to be almost extinct. By June 24, two lakes were active, just as they had been before, and they subsequently became one. For several years afterwards most visitors were privileged to witness interesting evidences of the presence of Pele.

* Hair of Pele, Goddess of Kilauea. Applied to lava of this volcano which, while fused, is blown by the wind into long delicate fibers.—EDITOR.

Fig. 2 is a photograph of the bottom of the pit taken about August, 1908. As the camera had to be placed about 200 feet above the lava, the whole of the lake could not be shown. The black ledge makes the steep bank in the distance. Three of the fire fountains appear next that wall very much like spray. Near the front is an irregularly shaped floating island of rock at whose edges is this fountain called "Old Faithful." The darker areas generally are the congealed crust. Next to the outside border the edge of liquid is apparent, always more conspicuous when the lake is sinking.

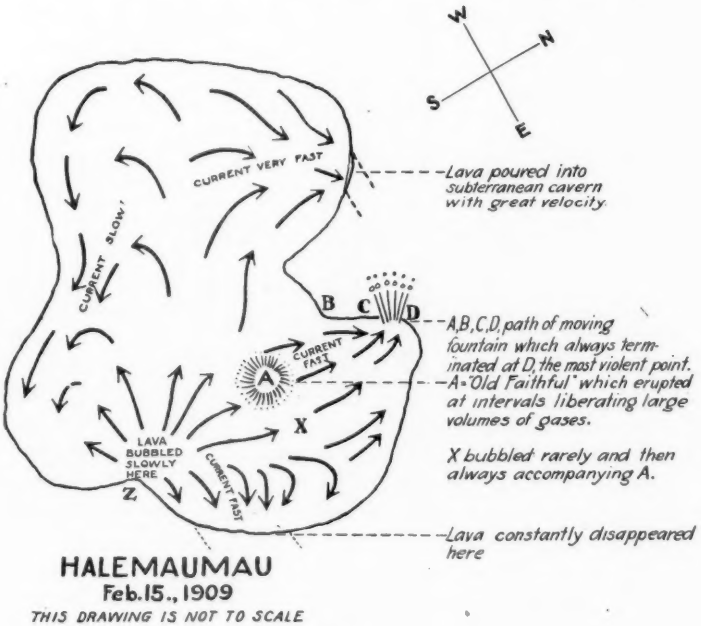


FIG. 3.

The long fascicles of lighter shade are fire lines which are developed by the photographer; I did not recognize them when looking down into the pit.

Early in the present year Bruce Cartright, Jr., of Honolulu, took observations of the action of "Old Faithful" in ten-minute periods, and kindly allows us the use of his diagram. First is a sketch map (Fig. 3) of the lake itself, showing the positions of the fountains, and the arrows indicate the directions of the currents and their condition of activity. At the northeast, the lava poured into a sub-

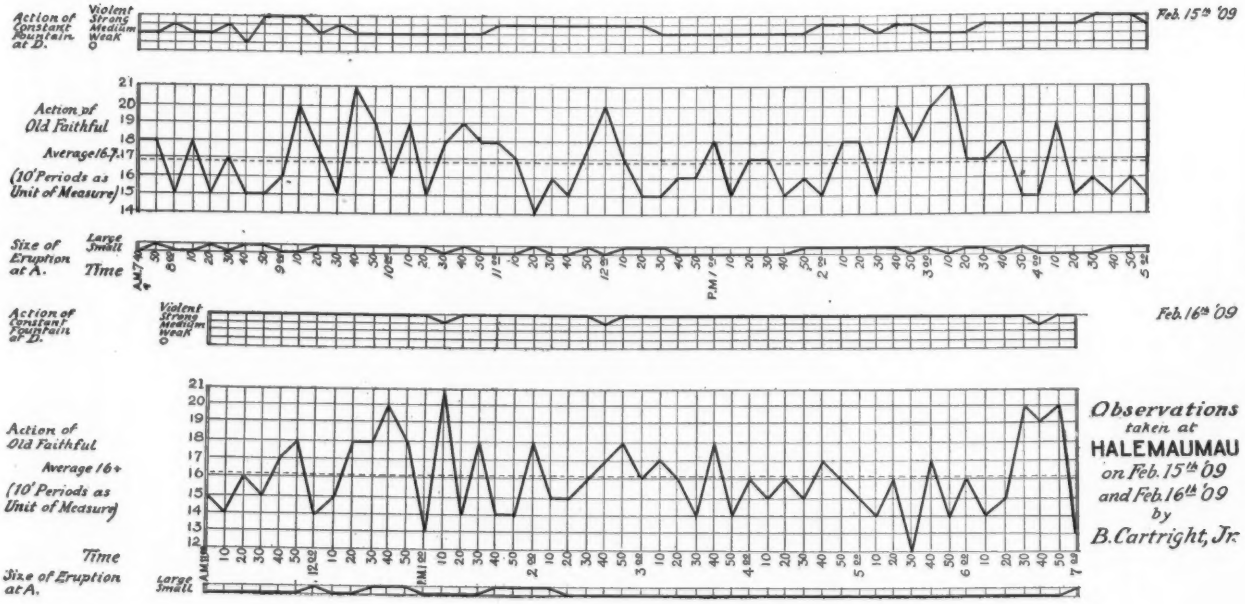

Action of Constant Fountain at D.
Violent
Strong
Medium
Weak
0
Feb. 15th '09
Action of Old Faithful
Average 16.7
(10' Periods as Unit of Measure)
21
20
19
18
17
16
15
14
Size of Eruption at A.
Large
Small
Time
A.M.
P.M.
Feb. 16th '09
Action of Old Faithful
Average 16+
(10' Periods as Unit of Measure)
Time
Size of Eruption at A.
Observations taken at HALEMAUMAU on Feb. 15th '09 and Feb. 16th '09 by B. Cartright, Jr.

FIG. 4.

terranean cavity with great velocity. A, B, C, D indicate the path of a moving fountain, which always terminated at D, the most violent point. A is the place of "Old Faithful," erupting at the intervals to be specified, liberating large volumes of gas or steam. At X there was a bubbling of similar character, always accompanying A to the right of Z, where the lava was constantly disappearing.

The second diagram (Fig. 4) indicates graphically the number of eruptions in periods of ten minutes for nine hours upon February 15, and eight hours the following day. The maximum number was 21 and the minimum 12, with the average of 16+ and 16.7+.

It is the first time that any attempt has been made to record the number and intensity of these outbursts, and the diagram may illustrate one of the class of observations that will be made when the Seismological Observatory shall be established at this locality.

RAILROADS IN ASIA MINOR.

BY

ELLSWORTH HUNTINGTON.

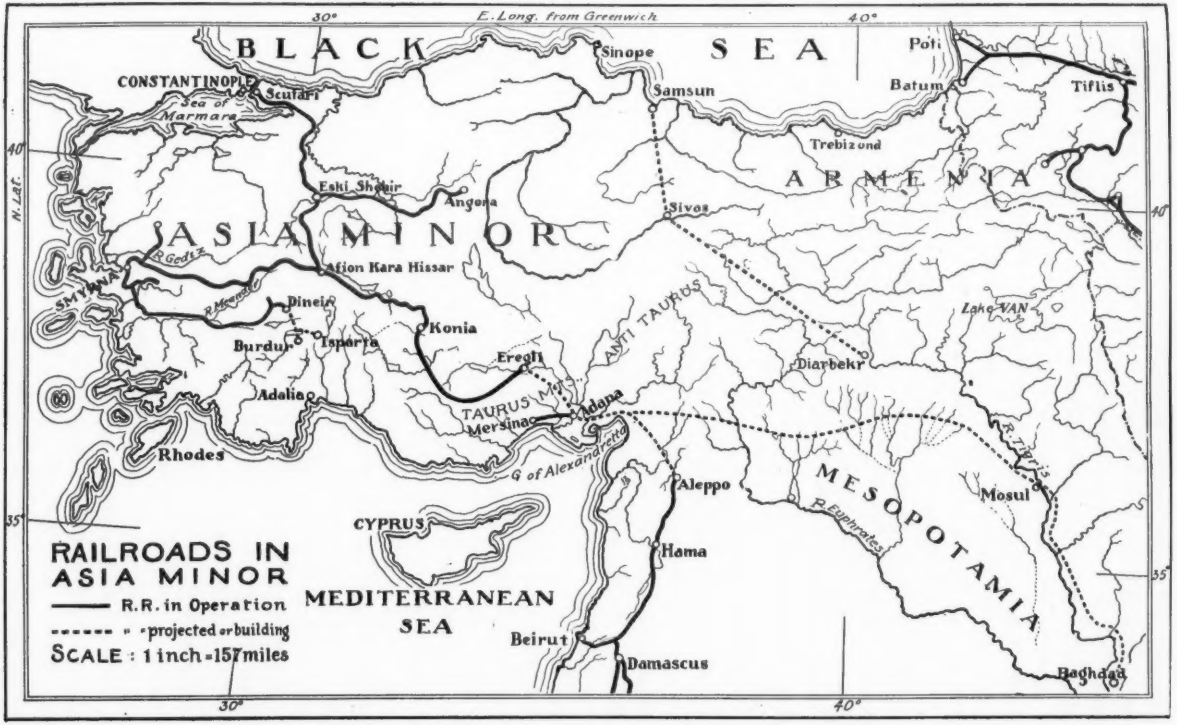
The year 1909 has been characterized by an important renewal of railroad building in Asia Minor. In addition to far-reaching plans, which are as yet only under discussion, there are other plans which are in actual process of accomplishment. The plans under discussion provide for a railroad which shall start on the Black Sea, presumably at Samsun, and go southward across the central plateau to Sivas, about 4,500 feet above the sea, and then southeast to Diarbekr at the southern foot of the plateau, whence it will continue into Mesopotamia to join the long-talked-of Baghdad Railway. From Sivas branches will run east and west along the plateau. The special object in view is to reach the rich mines of copper, silver and other minerals which might be worked to great advantage if transportation facilities were provided. An American company has offered to finance the undertaking with no other guarantee than the right to work all the mines along the zone within easy reach of the proposed railroad.

Far more definite than the plans mentioned above is the actual work now being accomplished upon the Baghdad and Dineir Railways. At the present day three railroads, financed by German, French and English companies, respectively, run up the long east

and west valleys which divide western Asia Minor into huge projecting fingers of mountains. The original German road starts at Scutari, opposite Constantinople, and follows the Sangarius River more or less closely eastward and southeastward for 300 miles to Angora. The French road runs almost due east from Smyrna up the Gediz River for 200 miles to Afion Kara Hissar; and the English road, also starting from Smyrna, goes south along the seacoast to Ephesus and then east up the Meander River nearly 200 miles to Dineir. All three roads come to an end on the barren plateau of Asia Minor at an elevation of about 3,000 feet. In addition to these, another line, the finely equipped Baghdad Railway, leaves the old northern line, half way from Constantinople to Angora, at Eski Shehir where the plateau is first reached, and runs southward 75 miles across the plateau to Afion Kara Hissar, where it joins the road from Smyrna up the Gediz Chai. Then it runs southeastward 300 miles farther to a point a little beyond Eregli and comes to an end at the northern base of the high mountains which border the plateau and shut it off from the northeast corner of the Mediterranean.

For years the Baghdad Railway has had no connection with the French line to Smyrna. The two stations at Afion Kara Hissar were a mile and a half apart, and the government would not allow them to be connected ostensibly because the building of the extra two kilometers of line would add a trifle to the kilometric guarantee paid by the state. Five years ago the railroads undertook to build the connecting link without permission. They built it and the line was promptly torn up by the government. So for five years more all traffic from the interior of the plateau to Smyrna was subjected to the great delay and expense of transfer by wagons at Kara Hissar. Under the new régime the link has once more been built, and since the spring of 1909 has been in operation. The real cause of the former opposition of the government was probably the desire to concentrate all trade at Constantinople. Smyrna is the natural outlet for the greater part of Asia Minor, and there can be no doubt that the new arrangement will increase its trade at the expense of Constantinople. The recent growth of Smyrna to a size of nearly 350,000, as it is now estimated, shows the strength of its opposition commercially.

For six or seven years the Baghdad Railway has waited at the edge of the plateau. At last it is about to cross the mountains and drop down to the warm, fertile Cilician Plain at Adana close to the northeast corner of the Mediterranean Sea. Already surveys have been completed across the Taurus range, which here borders the



ROUTES OF PROJECTED LINES ON THIS MAP SHOW MERELY GENERAL DIRECTIONS.

plateau, and the building of the track will begin at once. The highest point reached is about 5,000 feet above sea level. From there the road will run down the Chakit River, a branch of the Seihun or ancient Sarus which flows through Adana. The famous Cilician Gates, through which Darius, Xenephon, Alexander and other conquerors have passed, will be left about five miles to the west of the line. From the pass over the Taurus to the edge of the Cilician plain there is a descent of nearly 5,000 feet in a distance of about 70 miles as measured along the Chakit River without reference to the minor windings. Part of the distance is through an almost inaccessible gorge. Here there is a fall of over 2,000 feet in scarcely 20 miles; so that the average grade for the entire distance is one in fifty. Numerous tunnels will be required. German and Greek engineers are now engaged in laying out the route which bristles with difficulties.

At Adana the Baghdad Railway will connect with the short line some forty miles long which traverses the Cilician plain in a southwesterly direction through Tarsus to the seacoast at Mersina. The main line will not here touch the seacoast, but will go on eastward to get around the northeast corner of the Mediterranean. As yet it has not been finally decided whether the line shall go directly across the Giaour Dagh Mountain of the Amanus range and so by the shortest route to Aleppo, or whether it shall skirt the coast for forty miles to the small port of Alexandretta and then cross the mountains to Aleppo. Neither route is easy. The present wagon road from Alexandretta to Aleppo crosses a pass 2,000 feet high within ten miles of Alexandretta. The difficulty of surmounting this pass is the reason why the engineers are searching for an easier way which shall avoid Alexandretta. Altogether the section of the Baghdad Railway, from the Anatolian plateau to the great Syrian plain at Aleppo, involves engineering feats of the first class. According to the statements of the engineer in charge of the final surveys it is more difficult than any railroad in Europe except that of the Simplon in Switzerland.

It will probably be five years, and possibly more, before the Baghdad Railway will be completed as far as Aleppo. It will there connect with the Mecca Railway, which already is in operation, through Damascus to the holy city of Medina and will soon reach Mecca.

The Turkish railway project which is at present nearest completion is the extension of the nominally English railroad up the Meander R. beyond Dineir. The railroad reached Dineir a dozen or more years ago. Now it is to be extended along two branches, one to Buldur, forty miles to the south, and the other to Isparta, an equal

distance to the southeast. Both these places are towns of 20,000 or 25,000 people, famous for the attar of roses produced in their rose gardens. Already the railroad is almost completed to Kechi Borlu, the halfway station, whence the two branches diverge. The first seven miles from Dineir consists of a great curve seven miles in length, which brings the line back to a place only a little over a mile from the town, but 700 feet higher than the starting point. Here a limestone ridge is pierced by a tunnel 750 feet long and the road comes out upon a smooth plain famous in mythology as the place where Apollo flayed Marsyas after defeating him in playing the lyre. Thence for 14 miles the line to Kechi Borlu is easy. It is expected that the lines to both Isparta and Buldur will be completed within two years. The Isparta line will be continued twenty miles the following year to the picturesque town of Egerdir upon the beautiful lake of the same name. The lake lies near the southern edge of the Anatolian plateau. From it a valley leads southward to Adalia, about 100 miles away on the southern coast of Asia Minor. Down this valley a railroad will doubtless some day be built, but not at once, for there is a tremendous unexplored canyon fifteen or twenty miles in length where the valley crosses the edge of the plateau.

When the lines now under construction are completed Turkey will have a continuous railroad system nearly 2,000 miles long from the political capital on the Bosphorus to the religious capital in distant Arabia. After leaving the vicinity of Constantinople the railway will not touch the seacoast at any point except perhaps Alexandretta. The configuration of the mountains along the Syrian coast and of the high plateau of Anatolia forbid this. There will, however, be two outlets to the sea in Syria, namely the lines from Damascus to Haifa, the mediaeval Acre, and to Beirut. There will be another outlet in the Cilician plain, and still a fourth at the western end of the Anatolian plateau to Smyrna, the commercial capital of Asia Minor and almost of Turkey. In addition to this there will be the Dineir Railroad with half a dozen branches, all feeding into Smyrna, and various branches of the main line from Smyrna to Afion Kara Hissar. Altogether the western and southern parts of the Turkish Empire will be comparatively well supplied with railroads. As the facts given above well show, railroad construction in all parts of the Empire except the southern plains is full of difficulty by reason of the prevalence of mountains. The only place where mountains do not oppose constant obstacles to railroad building is the central part of the plateau which is either so dry or so high and cold that it possesses very little wealth and few inhabitants. Altogether, in

view of the physical nature of the country, the sparsity of population, and the nature of the government, it is remarkable not that Turkey has so few, but that she has so many railroads.

CORRESPONDENCE.

Some of the Difficulties of Precision in Circumpolar Instrumental Observations.*

To the American Geographical Society:—All navigators, even in well-known seas, know the liability to serious error in establishing their positions upon the best charts by what is known as "Dead Reckoning," particularly when for days they have been groping in fogs, driven by gales, tossed by heavy seas and suffering from effects of abnormal weather.

Upon approaching dangerous coasts the careful navigator makes large safety allowances for the uncertainties attending such calculations which depend so largely upon individual judgment as to the strength and direction of the invisible forces, which are constantly at work and so frequently drag the ship to its destruction. Drift or leeway, the force and direction of capricious currents, uncertain variations of compass, local deviations, errors in marking the speed of the ship, possible oversight of men, all combined, make dead reckoning only an approximation of the true position of the navigator in any part of the ocean.

These elements of error are enormously exaggerated in the Arctic seas, and, if Dr. Cook's and Commander Peary's declared positions should depend upon dead reckoning alone, they might have extreme difficulty in proving to the satisfaction of competent judges that either of them had reached their objective. Without the corroborative evidence of astronomical observations, their statements of success would be regarded as mainly guess work. Their "log books" could be written, and courses and distances plotted on charts in New York, without either of them doing more than disappearing from public view for the time covered by their records.

Throwing aside the dead reckoning, except so far as it adds to the interest of their narrations, and may be corroborative in some measure of their progress, it would seem that observations of the sun's altitude, both for latitude and longitude, must be the only means of fixing, even with approximate certainty, the position of the observer in circumpolar regions. The natural horizon, broken by ice hummocks, obscured by vapour, radiation and mirage, gives but an uncertain point of contact with the sun's lower limb, and an artificial horizon is therefore a necessary part of the equipment.

Artificial horizons are of two descriptions—one of mercury and one a mirror. The former, when the temperature is at or below the freezing point, must be warmed artificially, and the latter levelled by spirit levels, adjustment screws, and be placed upon a firm, solid base. Unless the spirit levels are warmed in the temperatures recorded, the spirits would freeze and levelling by them would become impracticable, however quickly applied. The mirror horizon on an un-

*Captain John S. Barnes, who makes this communication to the Society, was formerly of the United States Navy, and as a navigator of sailing ships, he was, for many years, charged with the responsibility of fixing with accuracy the hourly position of a ship upon long voyages in varying climates.

stable base would not give as satisfactory or truthful results, as the warmed mercury which finds its own level.

The allowances for refraction, excessive at such low altitudes of the sun, increased by the extreme cold and obliquity of the sun's rays passing through the misty atmosphere, and depending upon barometrical and thermometrical conditions, form elements of serious error in observations, depending largely upon the individual judgment of the observer.

The chronometers, or chronometer watches, regulated to Greenwich or Washington time in a temperate climate, cannot be expected to go on from month to month and year to year with absolute precision, particularly in such temperatures, whether carried on the person, or transported on sleds and subjected to violent shocks. Longitudes obtained by them may easily be erroneous—where one degree of longitude is barely one nautical mile. It is extremely doubtful if any navigator, however skilful, can find with approximate precision his longitude at or near the Pole, unless by a series of observations extending over a number of days, using the most accurate instruments and a perfectly correct chronometer.

The best made sextant, handled by a half-frozen, fur-clad man, cannot be infallible. It is doubtful if two observers at the same time and place, with separate but similar sextants would record the same altitude. Like all delicately adjusted instruments, extreme carefulness is necessary to preserve its integrity.

The results of Azimuth observations, if carefully and systematically made with proper instruments, would constitute valuable contributions to scientific knowledge, as to variations of the compass in Polar regions. It is to be hoped that Dr. Cook with his surveying compass, and Commander Peary with his theodolite, made frequent use of them, but the same difficulties in accuracy would prevail. It would be remarkable if either of the explorers preserved and can exhibit the actual figures of their astronomical observations and calculations.

Astronomical facts can not be created, manipulated, incorrectly stated or misapplied. An incorrect altitude at a given place and moment of Greenwich time will be apparent.

The navigating instruments used by Arctic explorers are necessarily few in number, light in weight, small in dimensions and delicate in construction, all subject to damage and errors, arising from the severe climate, the rough handling in sledge transportation, and are necessarily more or less incorrect in their renderings. All of them should be subjected to careful inspection on their return to observatories.

The astonishing physical endurance of the Arctic explorers under such trying conditions, their isolation, the constantly impending danger to life, benumbed by cold, half starved, fatigued almost beyond human limits, the absence of intelligent sympathy with the object by ignorant companions, without assistance in their scientific work, unite in making the stories of their exploits, matters of intense interest. One can only wonder that any men situated as Dr. Cook or Commander Peary describe themselves, could calmly make observations and work out the problems confronting them, with satisfaction to themselves or others.

Whether either or both of them ever reached the Geographical Pole remains yet to be proven, but the public has always sympathy for the relations of brave endeavour to accomplish what has been considered the impossible.

JOHN S. BARNES.

COLDBROOKE, LENOX, MASS., Oct. 11, 1909.

GEOGRAPHICAL RECORD.

NORTH AMERICA.

THE SURVEY FOR THE GEORGIAN BAY SHIP CANAL.—The Canadian government has decided to build this canal. The project of building a ship canal from French River Village, on Georgian Bay, to Montreal, has been discussed for years. The length of the canal will be 440 miles and will provide a deep waterway from the Great Lakes to the Atlantic *via* the St. Lawrence River. An enormous facility for transportating very cheaply to Europe the grain of the Canadian west, will thus be provided. It is believed, in fact, that the route will attract much of our own wheat exports from Minnesota and North Dakota, as providing a line of least resistance to the seaboard.

The proposed canal is to follow the French and Ottawa rivers to Montreal. The Engineering Board of the Ministry of Public Works began, in 1904, to make surveys and investigations regarding the feasibility and probable cost of the proposed waterway. Its voluminous report, submitted in January last, fills a volume of 600 pages, covering the ground in great detail and illustrated by many maps, plans and profiles, many of them in the volume and 56 others accompanying it. The main conclusion is that a 22-foot waterway can be established in ten years, for the largest lake boats, at a cost of $100,000,000, and that the annual maintainance will be approximately $900,000. Alternative routes for greater or less distances along the general line of the waterway are discussed and estimated upon.

THE CRUISE OF THE CARNEGIE.—The magnetic survey yacht, *Carnegie* sailed from St. John's, N. F., on Oct. 2, for Falmouth, England. Dr. Bauer was on board, but he will return from Falmouth to Washington. The *Carnegie* will leave Falmouth, under command of Mr. Wm. J. Peters, for Madeira and will return to New York, *via* Bermuda, in March.

SOUTH AND CENTRAL AMERICA.

GROWTH OF BUENOS AIRES.—The *Year-Book* of the City of Buenos Aires for 1908, issued in English (xxx and 366 pp.), shows that the population at the end of 1908 was 1,189,180, an increase of 59,894 over 1907, or a growth of 5.3 per cent. in a year, a rate that is not surpassed by any other city in the world. The principal factors in this growth were the excess of births over deaths and immigration. The birth-rate was high, compared with other large cities—34.31 per 1,000 inhabitants—and the death-rate was only 15.25 per 1,000 inhabitants. The birth-rate in London, for the same year, was 25.7 and in New York, 28.5. According to the *Year-Book*, only Chicago can boast of a more rapid growth than Buenos Aires, and is able to say that it has doubled its population within a shorter space of time.

THE GRAZING INDUSTRY IN PATAGONIA.—The grazing resources of Patagonia are now utilized to a very small extent, practically the only herds and flocks in the region being found along the eastern coast, where transportation facilities of

a sort are offered; or in the Punta Arenas region north of the Strait of Magellan; or at the headwaters of some of the Patagonian streams, as the Chubut, and the Valley of the 15th October, where Welsh colonists reside, and whence cattle may be driven northward and westward over Andine passes into Chile.

As an indication of the increased development of the grazing industry in southern Patagonia may be mentioned the newly established Patagonian Meat Preserving Company in the territory of Santa Cruz. The importance of the enterprise is sufficiently indicated by the activities of this company in 1908-9, when were exported 3,300,000 pounds of tinned meat, 550,000 pounds of grease, 88,000 pounds of extract of meat, and 9,000 tins of tongues, the entire product of the company being sent to London.

A railway has been projected from Port Desire westward to Lake Buenos Aires and actual construction will soon begin. This will open up a wide belt of country and will greatly stimulate grazing and allied industries along the eastern foot of the Andes and in the richer mountain valley about Lake Buenos Aires. I. B.

The Nitrate Industry in Chile.—The great nitrate combination, which for so many years had a complete monopoly of the whole business and fixed prices arbitrarily, was dissolved March 31, 1909, on account of the failure of some of the companies to adhere to the rules of the combination. It was claimed that the assignments of the directors of the amount of nitrate to be manufactured, were unfair to some companies whose works were operated cheaply because of better facilities. These companies insisted on a readjustment of the schedule on a different basis and, failing in their attempt, finally withdrew from the combination. Since this time, the nitrate business has been badly disturbed, and some of the works have even shut down on account of the decrease in the price of nitrate, which, in May, 1909, was quoted as low as $1.60 (gold) per quintal (101.42 lbs.), the price in the same month of 1907 having been $2.13. The Chilean government imposes an export tax of 56 cents per quintal, and is, consequently, deeply interested in the situation. About three-fourths of the revenue of the state is derived from this source. So serious has the condition of the market become, that there is a strong desire among the owners of the 145 works now in the country to agree upon some working basis which shall control the market and re-establish the old prices. I. B.

Argentine Enterprise.—Argentina has for some years been a serious competitor of the United States and Russia in the wheat markets of the world, an interesting phase of the competition being indicated by the fact that since 1903 Argentine flour has practically driven out United States flour from southern Brazil. Over 74 per cent. of all Brazil's imports of flour come from Argentina, while only 16 per cent. come from this country. In addition, practically all the flour milled in Brazil is from wheat imported from Argentina. With the extension and early completion of the railway westward across the Andes, we may look for larger exports of flour to Chile, and even to Peru, *via* west coast steamers. There is room for 200,000,000 people in Argentina, where but 5,000,000 live to-day, and with the increased utilization of the land, Argentina's influence must spread over the southern two-thirds of the continent and in many markets become the dominating influence.

Already Argentina is second only to Australia in the number of sheep and

third with respect to the United States and Russia in the number of both cattle and horses. An extended drought in the southern part of the province of Buenos Aires has caused serious losses of live stock among small farmers, but the larger farmers, with vast tracts of alfalfa and many artesian wells, will be but little affected.

An interesting phase of industrial development in the River Plate region is the growing lack of labourers, due to the expansion of the lumber industry on the Paraná and Paraguay tributaries. Eight thousand to 10,000 men are now employed on the Paraná at Posadas for the up-river lumber business, but the wages are steadily increasing with increased difficulties in getting men. In the face of this condition, lumber is imported from the Gulf ports of the United States in growing quantities. Eight steamers have recently been chartered for the business and will ply between Mobile, New Orleans, etc., and ports on the Plate in Uruguay and Argentina. I. B.

AFRICA.

THE JUBA RIVER FORMS A NEW MOUTH.—According to a Reuter despatch from Rome, the Juba, which forms a part of the boundary between Italian Somaliland and British East Africa, has formed a new mouth, 450 yards in breadth. It has also developed a long lagoon, which, at small expense, may be converted into a serviceable harbour. Some months ago, a violent typhoon broke through the spit of land separating the lower river from the sea, and the combined action of the sea and the current produced this remarkable change in the geographical conditions at the river mouth.

Some way up the Juba, an interesting discovery is reported by Capt. Ferrari of the Italian service. The large river, Webi Shebeli, is still represented on the maps as losing itself in the marshes of the Ballis country, but it is now found to be an affluent of the Juba, into which it flows about 120 miles above the mouths of that river.

ASIA.

MR. ELLSWORTH HUNTINGTON'S LATEST TRAVELS IN ASIA.—Mr. Huntington returned home early in October, after a most profitable journey of eight months. About two months were spent in going and coming, and the remaining six in Asia. When he started, he planned to spend only about two months in Palestine and Syria, and the rest of the time in Asia Minor. After visiting the Dead Sea, however, and sailing about it in a canvas boat, he became so much interested in Palestine that he prolonged his stay there to four months. Starting from Jerusalem as a center, he and his assistant made expeditions in all directions into the wild border regions of the Syrian Desert, the Negeb or South Country, the Druze Mountains and the Leja with its volcanic flows. They also went as far as Palmyra and northern Syria. Finally, at the end of June they returned to Jerusalem to have a look at the country in the dry summer, as well as in the verdant spring. In this way it was possible to see not only Palestine itself, but also all the highly various types of surrounding country which have so profoundly influenced the history of the Jews. Throughout the journey, special attention was paid to climatic problems, and it was found that the phenomena of Palestine agree with those of Central Asia in a remarkable degree.

In early July, Mr. Huntington went up to Asia Minor by way of the Cilician Palin and the City of Adana, where the recent Armenian massacres took place. The months of July and August were devoted to a study of the lakes of Central Asia Minor. Their variety is astonishing, for half a dozen distinct types are found in close proximity. Part of the time was spent in the remarkably beautiful forested region which lies in the middle of the south side of Asia Minor. Here it was found that peculiar topographic conditions give rise to summer rains, and hence splendid forests lie close to regions so barren that the population cannot live solely by agriculture, but must depend upon flocks and practice nomadism.

On the way home from Turkey a flying visit was paid to Greece. A study of the alluvial deposits which cover the Olympian plain and from the midst of which old Olympia has been excavated, yielded surprising evidence of the manner in which the climatic history of Greece has been parallel to that of regions 2,000 or 3,000 miles farther east.

German Explorers Murdered in Western China.—Dr. Brunhuber and Mr. Schmidtz, of Germany, went last year to the unknown middle course of the Salwin River, in China, a little east of Burma, for the purpose of surveying that part of the river and making ethnological studies among tribes, over whom, according to Mr. Davies, in his recent book on Yunnan, the Chinese Government has inadequate control. A letter from a missionary, published in the *Allgemeine Wissenschaftlichen Berichte* says that while the explorers with their Chinese servants were in camp on the bank of the Salwin, they were attacked by neighbouring villagers and both the white men were killed.

AUSTRALASIA AND OCEANIA.

New Exploration of the Kaiserin Augusta River, German New Guinea.—The *Geographical Journal* summarizes from the *Deutsches Kolonialblatt*, for Aug. 1, the results of Herr Full's ascent of this river for 200 miles from its mouth, in Nov., 1908. This great river was brought to light in 1886-7, but no further steps have been taken, till last year, to show its value as a commerce carrier and the resources of the region through which it flows. The explorer says that the mouth of the river is not obstructed by a bar, and is about a mile wide, and that the river is from 300 to 400 yards wide as far as the highest point reached. The lowest part of its course leads through a region of sago swamps and lagoons, but the banks are well marked, and only for a short stretch, about 40 miles from the coast, does it form a lake-like expanse with islands. The channel is in no way obstructed and, in the deepest part of it, maintains a depth of at least 50 feet throughout the entire section examined. Soundings were taken every ten minutes. The wide alluvial plain is broken, here and there, by wooded hills and the position of villages is marked by plantations of bread-fruit trees and groups of cocoa-palms. The natives were not hostile, but, above 55 miles from the mouth, they spoke a language unknown to the interpreters. Their houses are among the most imposing in German New Guinea, though their arts show little trace of outside influence. Their canoes are made of a single tree and can carry 15 men. They raise tobacco both for their own use and for trading purposes. The writer says that the river forms the natural means of access to the western interior of German New Guinea, and that the fertile lowlands are well adapted for the cultivation

of tobacco and other tropical products. Climatic conditions, however, are not favourable to settlement and development is not likely to be rapid.

POLAR.

NEW BRITISH ANTARCTIC EXPEDITION.—The *Geographical Journal* announced, in October, that Captain R. F. Scott, leader of the British Antarctic expedition in 1902-3, is now prepared to complete the work that he began and that Lieut. Shackleton so successfully continued. The objects of the expedition are to reach the south pole and to complete the scientific exploration of the Ross Sea area. He proposes to establish two bases, one in McMurdo Sound, South Victoria Land, and one in King Edward VII Land. If a favourable spot for headquarters is found in King Edward VII Land, the larger force, equipped for the south pole sledge journey, may be landed there, while the smaller party will continue the observations in McMurdo Sound and its region. On the other hand, if the wintering spot in King Edward VII Land should prove unfavourable for southern exploration or its latitude greatly increase the distance to be traversed to the pole, a small party will be established there to carry out a scientific exploration of the region. The main force, in that event, will be landed at McMurdo Sound, and will attempt not only to make the journey to the pole, but also further to explore the mountainous land in a south-easterly direction and ascertain whether it is connected with King Edward VII Land, or whether it continues in the direction of Graham Land. The effort will be made to add substantially to the magnetic, meteorological and geological results of the earlier expeditions.

A later report says that Captain Scott has acquired for the expedition the *Terra Nova,* a bark-rigged whaler of 749 tons built in Scotland twenty-five years ago and of late years employed in sealing off the coast of Newfoundland. With a nominal horse-power of 140, she makes nearly nine knots, and has sailing qualities which specially fit her for the work in view.

She will leave the Thames in August, 1910, going to New Zealand, and is expected to start from there in December. Every person employed will be of British nationality, the age limits being 25 and 40. Lieut. Evans, Capt. Scott's first officer, gives the following explanation of the methods to be followed in making the final dash:

The party will consist of six men, including Scott and himself. They will work a series of relays, carefully arranging the question of food transport in view of a prolonged sojourn from the base. Three modes of transport are available, ponies, dogs and motor sledges, and it is on the last named that Capt. Scott seems inclined to place chief reliance. He has been experimenting on snow slopes in Norway with a motor shod with hardwood runners which are fixed in sections on endless bands in the same manner as in caterpillar traction engines, which have proved well adapted for negotiating rough ground, and he has every confidence that this novel plan of locomotion over glacier ice will prove an important factor in solving the problem of traction, which is the real problem of the south pole.

The officers and crew for the expedition have all been selected.

AMUNDSEN'S NEXT EXPEDITION.—The *Bulletin* gave last year (Vol. 40, p. 751) details of Captain Amundsen's plans for putting Nansen's vessel, the *Fram,* into the ice of the Arctic Ocean north of Point Barrow, Alaska, in 1910, with the expectation of drifting for several years across the polar area. He has recently announced that he expects to set out on this drift about June 10, 1910.

DR. BRUCE'S LATEST WORK IN THE ARCTIC.—Dr. W. S. Bruce with his party, which left Leith, in July last, on the steam yacht *Conqueror,* has returned to Europe with all well on board, and reports that he has completed the survey of Prince Charles Foreland and made important geological and other investigations.

PROPOSED AIRSHIP EXPEDITION TO THE POLE.—It is contemplated, in Germany, to attempt to reach the north pole in a Zeppelin airship. The executive committee having the remarkable project in hand, held a meeting at Friedrichshaven, early in October, and it was decided that a preliminary expedition should be sent next summer to Spitzbergen to investigate the polar ice and determine the conditions affecting the management of airships in those regions. The committee laid great stress upon the importance of developing Zeppelin airships for long journeys, especially over the sea, for purposes of scientific investigation. Plans are to be prepared for the construction of a suitable airship to be ready early in 1911.

CLIMATOLOGY.

HISTORICAL CHANGES OF CLIMATE.—In the *Monthly Weather Review* for November 1908, Mr. Ellsworth Huntington has a discussion of "The Climate of the Historic Past," a subject to which he has paid much attention during recent years. This article gives a short systematic summary of the evidence which Huntington has gathered during his journeys in Asia, and in connection with his study of the literature of the subject. Those who wish to gain a general view of this interesting investigation will find the present article worth serious consideration. It summarizes what the author has already set forth in his "Pulse of Asia," and in numerous separate articles, which have appeared in the *Bulletin* and elsewhere.

Huntington's view, in brief, is that there have been changes of climate during historic times, the characteristics of which were intermediate between those of the glacial period and those which now occur within the limits of contemporary observation. At the dawn of human history the climates of most of Asia, and apparently of all continental regions between the 20th and 50th parallels, seem to have been decidedly moister, and, presumably, cooler, than at present. The change from the climates of that time to the warmer and drier conditions of the present, apparently took place irregularly in a pulsatory fashion. The slow swing from the cold, moist climate of the last glacial epoch to the warm, dry climate of the present post-glacial epoch is as yet scarcely complete.

A review of certain observations on the Zuni ruins of New Mexico; of the apparent decrease in the size of Lake Tezcuco; of the evidence based upon the Inca terraces near Lima, and of reports contained in the writings of Darwin, and later of Moreno and others, leads Huntington to the conclusion that the climatic histories of the Old World and of the New World have been essentially the same. On the whole, there seems to have been, within historical times, an increasing degree of warmth and aridity. As to the cause, the suggestion is that this is probably to be found in variations in the intensity of solar radiation, during long periods.

It may be noted, by way of comment on this recent discussion of Huntington's, that meteorologists are very clear about one fact, and that is that within the period during which meteorological records have been kept there has been no appreciable change of climate. This period is, however, relatively only a very

short one. Evidence of a tendency towards a drier and a warmer period occurring within historical times, such as has been adduced by Huntington as a result of his work in Asia, is not, it must be remembered, necessarily evidence in favour of a permanent, progressive change. There is much confusion in the use of the word change of climate. What is often spoken of as a change may simply be a long period oscillation. There is obviously a difference between a permanent progressive change, and an oscillation. R. DEC. W.

SENSIBLE TEMPERATURES.—A discussion of sensible temperatures from the point of view of an experimental psychologist is found in a paper by Prof. E. B. Titchener, entitled "The Psychophysics of Climate," and published in the *American Journal of Psychology* for January, 1909. The author finds striking instances of what he calls "psychophysics by common sense" in the original suggestion of J. W. Osborne (1876) in his "Determination of Subjective Temperatures" (*Proc. A. A. S.*, 1876), and in recent papers by W. F. Tyler, dealing with the so-called "hythers," reference to which has been made in the *Bulletin*. Professor Titchener remarks that he would "like to see some of the younger generation of climatologists pass through the drill of the psychological laboratory," and "some student of experimental psychology take up the meteorological problem." A bibliography is appended, which will prove useful to those who wish to make a further study of this interesting subject, on the border-line between meteorology and psychology. In the *Bulletin*, Vol. XXXVI, No. 3, pp. 129-138, is a summary of the factors concerned in sensible temperatures, and a review of the work done up to the time of publication of that article, with a condensed bibliography.

R. DEC. W.

OBITUARY.

DR. GEORG VON NEUMAYER.—Dr. von Neumayer died at Neustadt-am Haardt on May 24 at the age of 82. His fame as a man of science was international and he had many friends in all lands. He directed the Deutsche Seewarte, the German Naval Observatory at Hamburg, from the day of its founding, in 1876, till he retired from active life in 1903. He was the founder and editor of the *Annalen der Hydrographie and maritimen Meteorologie*, was one of the foremost authorities in terrestrial magnetism and meteorology, was very influential in the promotion of polar research, especially antarctic, and wrote many scientific papers.

MAJOR ERNEST CAMBIER.—Major Cambier, who died in Belgium, in July last, aged 65, was prominent in African service for many years. From 1877 to 1884 he was connected with the International African Association, founded the station at Karema, on Lake Tanganyika, and was prominent in the work of pioneer development in East Africa. Later, he was in charge of the economic researches in the Congo Independent State, recommended the building of the railroad around the lower Congo rapids to Stanley Pool, and served for two years as inspector of the State, exercising the functions of Governor-General.

THE MARQUESS OF RIPON.—This British statesman died in July last, a few days before his 82nd birthday. He was one of the early presidents of the Royal Geographical Society, and it was in his honour that Speke named the falls, where the Nile has its outlet from Victoria Nyanza, Ripon Falls.

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GEOGRAPHICAL LITERATURE AND MAPS.

(INCLUDING ACCESSIONS TO THE LIBRARY.)

BOOK NOTICES.

Deutschland und der Kongostaat. Ein Appell an die deutschen Handelskammern. By Ernst Vohsen. 72 pp., and Map. Dietrich Reimer (Ernst Vohsen), Berlin, 1908. M. 1.

A strong and able criticism of the trade policy of the former Congo State. The Berlin Congress of 1885 provided that all nations should enjoy complete freedom of trade in the entire Congo Basin. Monopolies and special privileges were expressly forbidden. But in spite of these provisions, the government of the Congo State declared all land not actually occupied by the natives to be government domain and monopolized in these large regions the rubber and ivory trade, extorted forced labour from the natives and made it impossible for any one not in the government service to carry on business. Later, wide areas were assigned to certain trading companies, in which the government was interested, exclusive privileges were given to them and free trade was absolutely a dead letter in the State. At the same time Germany was extending her railroad system in German East Africa, towards the west, and the export products of the eastern Congo region would naturally go to the Indian Ocean as the shortest route to the sea, but the Congo government was opposed to such a diversion of trade from its own routes to the Atlantic.

Mr. Vohsen has, in this brochure, fully set forth the facts as involving questions of great national importance in Germany, and appeals to the business interests of the country to bring their influence to bear upon the German government with a view to an official demand that the terms of the Congo Act be fulfilled. Now that the régime of the Congo State has been supplanted by that of the Belgian Colony of the Congo, it may be that the intentions of the Berlin Congress will, at last, be carried out.

Les Planètes et leur origine. Par Ch. André. ii and 285 pp., 94 Figures in the Text and 4 Plates. Gauthier-Villars, Paris, 1909. Frs. 8.

The author, Director of the Lyons Observatory, divides his book into three parts, devoting the first to the planets, the second to the satellites, and the third to the formation of the planetary system. His introductory chapter is a brief statement of the three fundamental laws of Kepler relating to the planetary orbits and the law, established by the mathematician Titius and the astronomer Bode, governing the distances of the planets from the sun. The book is extremely well and clearly written, is finely illustrated and will fully serve the purposes of a work of reference and a popular elucidation of the subject. In the chapter given to Mercury and Venus, Mr. André discusses and approves of the temperature investigations of Professor Poynting, the Birmingham astronomer, who assigned these mean temperatures: Mercury, 193° C.; Venus, 66° C.; and the Earth, 16° C. In his long chapter on Mars, he presents the views of Lowell and Pickering as to the existence of animal life on that planet, together with the objections to that hypo-

thesis, and expresses the opinion that the Martian canals may be merely an optical delusion. The third chapter is given to an excellent discussion of the asteroids, which adds little to previous treatises except that the author gives the details of the discovery, in 1906, at Heidelberg, of the minor planet T.—G., by Mr. Kopff. Each of the other large planets has a chapter and we have the author's opinion that there are no planets inside of Mercury or beyond Neptune, for there is little doubt that they would have been discovered if they had existed.

Mr. André's study of the satellites, in the second part, is interesting, not only for his historical development of the subject, but also for the information they afford as to the physical constitution of the planets they accompany. His story of the discovery of the eighth satellite of Jupiter shows that the author has availed himself of the most recent astronomical data. Mr. Melotte, of the Greenwich Observatory, reported the discovery, on Jan. 27, 1908, of a very feeble star (16th magnitude) which he thought was an asteroid. It is in the part of the heavens near Jupiter, and later observations suggested the idea that it was a satellite of that planet. They also supplied data from which Mr. Crommelin was able to calculate its relative orbit and he found that it was the eighth of Jupiter's satellites, twice as distant from the planet as the sixth and seventh satellites, making its revolution in three and a half years and presenting the anomaly of having a retrograde orbit. The third part, dealing with the formation of the planetary system, recounts the nebular hypothesis of Laplace and its subsequent modifications and enlargements by later students, but says nothing of the new hypothesis of planetary origination evolved by Professor Chamberlin of the University of Chicago.

Südamerikanische Felszeichnungen. Von Dr. Theodor Koch-Grünberg. 92 pp., 36 Illustrations in the Text, 29 Plates, Map and Index. Ernst Wasmuth, Berlin, 1907.

The book, very finely produced, is an exceptional contribution to knowledge of primitive carvings on rocks throughout South America. The well-known explorer not only describes and illustrates all the petroglyphs and drawings he found during his pioneer exploration on the upper Negro River and its western tributaries and on the Apaporis affluent of the Yapurá R., but he also summarizes similar discoveries made by earlier explorers and reproduces many of their pictures. These rock engravings or drawings are, in fact, very widely distributed in South America, and especially in the Amazon basin and the entire north of the continent. He finds that many of the explanations of these rock pictures, given by his predecessors, are more or less fantastic. The subjects cover a wide range, many representing animals, utensils, weapons, masks, the rude ornamentation on various Indian manufactures, etc.; others appear to be merely the whim of an idle hour, and all illustrate the lowest stages of culture. The work does not deal with the rock pictures in the Cordilleras which represent a more advanced degree of culture and are of a very different character. It is interesting to hear that the later Indians give considerable attention to deepening the work of their fathers and thus keep them from obliteration.

Haiti. Son histoire et ses détracteurs. Par J. N. Léger. 411 pp., 15 Illustrations from Photographs and Appendixes. The Neale Publishing Co., New York and Washington, 1907.

The book is also issued in English. It will help to stimulate more intelligent interest in Haiti and its people. The author, Minister of Haiti to this country,

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gives about two-thirds of the work to a history of the island and of the origin and development of the negro republic. The historical facts are presented in an orderly manner and, of course, there is much human interest in this story of the revolt of slaves and their achievement of freedom under masterful leadership and of the overthrow of the foreign governmental régime. In the second part, the geography, climate, flora and fauna are treated as well as the characteristics of the people, their government, schools, religion, business activities and commerce. Considerable space is given to the refutation of many startling reports concerning the inhabitants, such as their alleged addiction to cannibalism, their baleful superstitions, the process of their retrogression into barbarism, etc. The author gives evidence that not a few of these reports are sensational, with little or no basis in fact. He shows, for example, that a particularly lurid statement relating to cannibalism, put into the mouth of a well-known geologist, was really written by a Washington sensation monger, and he prints the emphatic disclaimer of the geologist.

L'Argentine au XXe siècle. Par Albert B. Martinez and Maurice Lewandowski. Avec une Préface par M. Émile Levasseur, membre de l'Institut, et une Introduction par Ch. Pellegrini, ancien Président de la République Argentine. Third Edition. lxi and 432 pp. and 2 Maps. Armand Colin, Paris, 1909. Paper, 5 frs.

Though only three years have elapsed since the first edition appeared, it is not surprising that a third reprinting, with many and important changes in the text, is already necessary to show the Republic as it is to-day. No other country is making such rapid strides in the development of agricultural production; and other phases of development are following in the train of this mighty movement. The area devoted to crops and grazing has expanded from 9,000,000 hectares in the summer of 1904-5 to 14,000,000 in 1908-9. Twenty-five years ago, Argentina was importing grain to feed its people, but in the last growing season it raised a ton of wheat for every citizen of the republic and its total harvest of grains was 13,811,000 tons. The maize crop has grown from 720,840 kilos in 1905 to 10,742,320 in 1908; the leather and hides from 17,713,219 kilos to 22,371,525. In 1880, the commercial movement of the port of Buenos Aires represented hardly 650,000 tons; to-day, it has passed 13,000,000 tons and Buenos Aires is among the great ports of the world.

In this book we find the facts of this tremendous material growth and the reasons for them. Argentina has been discussed in larger books, as authoritative as this one; but this is the only work that has been brought up to date, that shows the country as it now is and that is able, from the present outlook, to give an idea of what it may become. After a chapter on the plan and methods of the book the authors discuss the Argentine nation, its government, the qualities of the people, their faculty for assimilation and the fact that Anglo-Saxon energy (over 40,000 North European people are now citizens of the Republic) is augmenting the potency of the Latin races that are the predominant factor in the country.

The geographical factors that are influencing the development of Argentina are prominent in all the 251 pages given to the treatment of the resources and economic progress of the country, but a special chapter is given to the varieties of climate; to the soils, surpassingly adapted for crops and grazing, though only about one-fifth of these lands is, as yet, utilized; to the rivers and their exceptionally favourable rôle as a means of transportation; and to the ports and the part

of each in the economic régime. Bahia Blanca is becoming especially interesting, because the vast, rich country behind it is rapidly developing, port works to cost $50,000,000 are in course of construction and the city will ship the products of its great hinterland direct to Europe and America.

There are long chapters on railroads and colonization, 112 pp. on agriculture and stock raising, and 113 pp. on the commercial and industrial aspects of the country, including mining. The last part of the book is a careful discussion of the finances of Argentina.

Reasons are given for the belief that, in time, the country will attract a great stream of permanent immigration. Few parts of the world are, in all respects, ideal, and the disadvantages found in Argentina are plainly set forth, as, for example, the droughts that occasionally diminish production, the plague of locusts against which the government now hopes successfully to contend, and the lack of coal and iron and of water power suitably placed for industrial uses.

The great amount of material in this work is very ably handled. The book is no mere compilation of facts, but the facts are there, with philosophical discussion of them. Everybody who desires to know what Argentina is and what it may be must read this work.

The Navajos. By Oscar H. Lipps. 136 pp. 17 Illustrations from Photographs, Sketch Map and Appendix. The Torch Press, Cedar Rapids, Iowa, 1909. $1.

This book in no way supplants earlier publications on the Navajos, whose characteristics and remarkable history make them especially worthy to be well-known. It is a short and popular narrative for the general reader. It would be desirable if its allusions to the geology and geography of the Navajo Reservation, about a third as large as New York State, were more adequate. The sketch map is poor and does not include the names of all the headquarters of the Indian superintendents on the reservation; but the illustrations are good and the book fulfills its purpose of presenting an accurate account of the Navajos, their past and present. Such a work will have more readers than elaborate reports and will thus serve a good purpose.

The author says the Navajos never wear the famous products of their looms for the same reason Meissonier gave for the non-appearance of his own paintings on his walls. They say they cannot afford to wear blankets of their own make because they sell them for several times the sum which they pay to traders for ordinary Indian blankets.

The Far East Revisited. Essays on Political, Commercial, Social and General Conditions in Malaya, China, Korea and Japan. By A. Gorton Angier. With a Preface by Sir Robert Hart. xii and 364 pp., 34 Illustrations from Photographs and Index. Witherby & Co., London, 1909. 10s. 6d.

One sterling quality in this travel record of an experienced traveller is its possession of perspective. This is the narrative of Mr. Angier's fourth visit to the remote Orient and he is thus able to orient his present impressions with the ideas he had formed seven years earlier, and behind this lies an horizon of yet earlier knowledge of the affairs which form the theme of the present volume. In the intervals of the trips the author has far from lost sight of the lands which he had learned to know and which he was to revisit, for as editor of the "London and China Express" he was always in touch with the commerce originating in China

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and Japan and using the Malay Seas. And where British commerce goes British diplomacy, merely outdoor politics, rarely lags behind. Furthermore, Sir Robert Hart contributes a preface.

Therefore the sense of disappointment with the product is enhanced. From a trained newspaper man specializing for years in this field one would expect a record that would find lodgment among the authoritative works in the field of commercial geography. In this particular field the results which such an observer might have presented as one having authority are lost in a multiplicity of petty detail, port to port elaboration of important yet minor facts which would have been more impressive in the mass and more convenient for reference if presented in an appendix table. No amount of bulk obtained by multiplication of detail, all minor, can make up for the absence of breadth of view. One looks in vain for the broad picture which should show what is the true meaning of the fleets of cargo vessels in long parade past Singapore.

Where all is as seriatim as the list of stations on a railway time table we can do no better than to select for comment a single station, and our choice will naturally be guided by the personal, as national, appeal. Our author visited Manila, the capital of our Oriental domain which remains to our statecraft and to our investing capital so much of an enigma.

He finds that in seven years we have not solved the problem of the Orient. Seven years ago our statesmen did not know that there was a problem at all, not even now has that knowledge become sufficiently widespread to admit of the special measures of treatment which the conditions require.

Mr. Angier recommends a proper, permanent civil service for the government of the Philippines, the withdrawal of local self-government by Filipinos, the insistence that Filipinos should be polite to white men, the recruiting of Chinese coolie labor.

We more respectfully submit that these recommendations are based upon a half knowledge. The administration of a colonial dependency, more particularly when it involves the unfamiliar conditions of a wholly alien civilization, can only half be seen in the dependency itself. The motive, the administrative power, the mainspring of the whole system can only be studied at the seat of the government which is reaching over seas in honest effort if misguided.

But is it misguided? Certainly it is not British guided. Is it altogether wrong on that score? Naturally our author compares the first decade of the American Philippines with his familiar acquaintance with the administration of the affairs of millions of Orientals by the British handful of a civil service once carefully designated as covenanted, now apparently regarded, even if not definitely so designated, as sanctified. That appears in his whole attitude of comment. To those who can read the Anglo-Indian language it is distinctly stated in the sentence: "Without any undue harshness on the native, the Raj should not be amenable to him." We have our troubles in the Philippines, we have more troubles to come no doubt, but we have avoided the complications of a Raj. The latest information that reaches us of the heaven-sent dispensation of a Raj is that Hindustan is torn with sedition and the proper permanent civil service goes in fear of its life.

The British observer does not look beyond the Escolta, he does not see Washington, never once does there come to his mind every minor civil subdivision in the continental U. S. on which alone rests the empire overseas. He does not see how revolting to American citizenship is the thought of rule by might. He can-

not see that, having conquered the ancient masters of the Filipinos, we could not in the national conscience substitute another mastery. Our whole policy has been to bid the Filipino be a man. This is our experiment in the Far East, not in ten years can results be looked for.

We may be all wrong, but as yet we compare rather well with any British Raj who has earned the fanatic hatred of the dependent race. The writer of these lines has the less hesitation in this comment, has the less fear of the charge of American hifalutin, for the two reasons that he has intimate acquaintance with more than one British Raj, even in the region of the "Far East Revisited," and that he has had to bear the heat and burden of the administration of the affairs of an inferior race on the American plan. The idea of government by consent of the governed does not seem to have suggested itself to Mr. Angier as conditioning the American administration of the Philippines so fundamentally that the idea to us is intolerable of an American Raj. W. C.

Das heutige Neuseeland. Von Dr. Med. Max Hertz. 345 pp. Verlag v. Alfred Schall, Berlin, 1908. $1.50.

The author does not inform us in what capacity he visited New Zealand. From the contents of his book, however, the larger part of which is given over to descriptions of excursions in pleasant company, and from the style which rarely rises above a purely conversational level, one may suspect him to have been one of the tourists who visit that island in increasing numbers. His records must not, therefore, be measured by scientific standards; but they constitute a very entertaining book which tells interestingly about the country, its native and colonial population, its social and legislative history, etc. For the more scientific parts, the author acknowedges his indebtedness to the respective authorities. On the whole, the book can be recommended to everybody who wishes to read about New Zealand without burdening himself with too much technical ballast. It is a pity that the majority of the pictures are rather poorly executed, and the lack of an index, which alone would prove that the book makes no claim to a scientific character, is a great obstacle to really profitable reading of it. M. K. G.

Amerika-Wanderungen eines Deutschen. Von Johannes Wilda. 3 vols., pp. viii and 367–339–391. Allg. Verein für deutsche Literatur, Berlin, 1906. M. 18.

There are not many books of travel which cover as large a territory as these three volumes of Dr. Wilda's. From Alaska to Cape Horn there is hardly a point of importance on the Pacific coast which he did not visit, and about which he does not report in an interesting and entertaining way. What gives the book a more than ephemeral value is, however, not so much the descriptions of the countries visited, although some of them are very fine, as the study in political geography which they represent. Not travelling as an actual explorer, the author does not intend to contribute to the geography proper of those countries, unless by an occasional discovery, such as the determination of the tributaries of the Sarapiqui River and its lagoons and lakes. His intention is rather to supply "food for the political understanding" of South American and Central American conditions. His characterizations of the various forms and results of government from the republic of Colombia to British Columbia, and again in the various states of South America, are striking illustrations of the different workings of republican institutions with different races and on different levels of civilisation, which might furnish food for thought also to politicians of more advanced countries.

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The special object of the author, however, as the title of his book implies, was to study the political and commercial conditions and prospects of the Germans in the western hemisphere. He tells of many a lost opportunity, lost sometimes through lack of knowledge of actual conditions in the home offices, sometimes to lack of initiative, sometimes to lack of harmony among the German element abroad, and tries very hard to make his readers realize the necessity for Germany to hold her own on the western continents, not by political occupation, but by commercial penetration, because their central position between the two large oceans and the coasts of Europe and Asia will make the two Americas more and more the territory on which the large commercial prizes of the future will be won. M. K. G.

La Hongrie au XXme siècle. Étude économique et sociale. Par René Gonnard, professeur d'économie politique à l'université de Lyon. pp. xii–400. Paris, Libr. Armand Colin, 1908. 4 frs.

The author deplores, not without cause, that too little is known about Hungary abroad, and tries to give his readers a general picture of the agricultural, economic, and social conditions of that country by virtue of his personal observations and his study of original official documents of the Hungarian Ministry of Agriculture to which he had access. Incidentally, a large part of his book contains also geographical descriptions of the country itself which are real contributions to the Länderkunde of Europe. Hungary proper, or the country of the Magyars, is the political area of that name minus Transylvania and Croatia-Slavonia, which form geographical units by themselves by reason of their topographical as well as ethnological character. It is essentially the plain of the Danube and its tributaries, and may be subdivided into three, or rather four, smaller divisions: (1) the Mesopotamian region between the parallel courses of the Danube and Theiss rivers, the famous Alföld, an almost mathematical plain; (2 and 3) the higher plains east of the Theiss and west of the Danube, and (4) the hilly country north of these two rivers which gradually rises to the Tatra and Carpathian Mts. The Alföld is especially the heart of Hungary and the center of Magyar domination, and its landscape, with its grey or black soil, almost everywhere under cultivation, either as fields or pastures, its entire absence of rocks and pebbles even, and hence its bottomless roads where no bicycle or automobile has yet penetrated, its low houses of unbaked clay, its solitary lines of acacias, is a singular combination of greatness and monotony.

Nor do the silhouettes of the cities break the pervading impression of flatness, as even large ones like Szegedin, Kecskemét, etc., with from 60,000 to 100,000 inhabitants, are nothing but agglomerations of those low country houses, regular farmer cities, with no high buildings except the steeples of the churches and the domes of the synagogues. East of the Theiss the horizon is enlivened by occasional hills, and the country is intersected by rivers, tributaries of the Theiss, while the Alföld is practically streamless save for the two watercourses which bound it. This eastern plain is the country of cattle and horse breeding, with conditions quite similar to the American West. West of the Danube the country is still better watered, and especially rich in lakes; it is a country of fisheries and vineyards. The hilly district in the North is the least Magyar of the three, but rich in scenic beauty, and the home of the Tokay grape.

The opinion generally entertained abroad that the soil of Hungary is almost entirely monopolized by the large landowners is considerably exaggerated. No more than 12,000,000 hectares are taken up by the large estates, against 6,000,000

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hectares of middle-sized ones and 13,000,000 hectares of small estates. The existence of the two latter classes is endangered, however, by the divisions among the numerous children of the owners, which has led, partly, to the practice of Malthusian principles and partly to a diminution of the prospective heirs by emigration of the younger members of the families to the Unted States, less frequently also to South America. As a rule, the homes of the Hungarian peasant surprise the visitor by their cleanliness, neatness, and comparative comfort, while those of the large landowners are rarely less than enlarged specimens of farmers' houses, real castles being comparatively rare. The author gives many interesting descriptions of rich and poor homes which he visited, which convey a better idea of life in Hungary than could be gained by a most accurate systematic description.

The labour problem, once very simple, is beginning to be less so. The former serfs who still live on the estates as free servants are comparatively well to do; but an extensive legislation has seemed necessary to regulate the relations between day and season labourers and their employers. Socialism is penetrating even into Hungary, especially since the introduction of manufacturing into the once purely agricultural country, in obedience to the national desire for independence from Austria, both industrially and politically. A large part of the book describes the admirable efforts of the national government to foster these new industries and increase the returns of the soil by means of museums, experiment stations, technical schools, etc., which cannot fail greatly to improve the condition of the country and its people, if only the latter show themselves capable of profiting by such intelligent paternalism.

The author betrays himself as a warm friend of Hungary, and there are not many scientific publications which show so ostensibly their author's enthusiasm for their subject. How large a part of the latter has its foundation in the common antagonism of Frenchman and Hungarian against Germany and the Germans, and how much of it must be credited to personal reminiscences of an evidently very pleasant character, is not for the outsider to decide. At all events, the book gives an interesting account of the advantageous and hopeful traits of Hungary and its people, leaving it to others to supplement the picture by the shadows which must be there but of which this book makes no mention. M. K. G.

The Gateway to the Sahara. Observations and Experiences in Tripoli. By Charles Wellington Furlong. xxi and 306 pp., Illustrations, Maps and Index. Charles Scribner's Sons, New York, 1909. $2.50.

Comparatively little has been written on Tripoli, and recent years have added almost nothing in English and very little in other languages to books or reports on that country. Mohammedan-ruled, Tripoli is still in the Middle Ages, almost untouched by the progress that has revolutionized neighbouring Tunis and Algeria and looking askance at the white races.

Mr. Furlong has written a good though not a scientific book, and it is well worth a place on library shelves. He has fulfilled his intention to give, by word and picture, an accurate view of the old Barbary capital, its customs, industries and antiquated business ways, and of the primitive methods and patriarchal life of the people living in the oases and on the tablelands of Tripolitania. His coloured and black-and-white illustrations and photographs have unusual charm and vividly enhance interest in the scenes which they depict.

He gives also glimpses of life far south of the region of his travels, especially in the story he tells of Salam, one of his servants and formerly a Haussa slave and

also in his sketch of the Tuaregs whom he met. Ten years ago, the information he gives about these former masters of the desert would have been specially treasured, for they were almost unknown. The French have now shed a flood of light upon these tribes and one of the tests of the value of Mr. Furlong's book is his description of the natives, based upon what he saw of them. It is accurate as far as it goes. Among the author's topics are an account of the vocation of the Greek sponge divers off the Tripoli coast; the discovery of the wrecked hull of the U. S. frigate *Philadelphia,* burned in 1804; personal adventures in his trip with Arabs, 200 miles in the Sahara; the daily life and vicissitudes of the camel and Sahara caravans, the trails they follow and the unique charms of the desert; the esparto pickers who gather fiber for European markets. The record Mr. Furlong has made for us relates to a type of mingled civilization and barbarism that is passing away and it is the more valuable and timely on this account.

Fulfilment of Three Remarkable Prophecies in the History of the Great Empire State, relating to the Development of Steamboat Navigation and Railroad Transportation, 1808-1908. By Henry Whittemore. 80 pp. and Illustrations. Published by the Author, 1909.

The prophecies referred to are those of John Fitch, who wrote in 1785 that steam would some day be employed to propel vessels across the Atlantic and that steamboats would be preferred for river navigation; Oliver Evans, who said the time would come when people would travel in stages "almost as fast as birds fly, fifteen or twenty miles an hour"; and William C. Redfield, who wrote a pamphlet in 1829 predicting phenomenal development for the Western States as the result of great trunk railroads. The book is an excellent compilation, giving the history of the development and early days of steam transportation in our country.

Central and South America. Vol. 1. By A. H. Keane. Edited by Sir Clements R. Markham. Second Edition, revised. xxvi and 611 pp., 13 Maps, 84 Illustrations and Index. Edward Stanford, London, 1909. 15s.

Eight years have elapsed since the first issue of this volume in the complete rewriting of the standard "Compendium of Geography and Travel," published by Stanford. In that time, explorers have made much progress in the effort to reduce the area of the still untrodden regions, and there have also been numerous rectifications of frontiers. South America had also advanced in a material sense and especially in the development of railroads in Brazil, Argentina, Bolivia and Peru. All this wealth of new material has been utilized in this new edition to make the picture of the South American Republics true to our present knowledge and the existing conditions. The whole of the continent is treated, excepting the European colonies, British, Dutch and French Guiana, which appear in the volume on Central America and the West Indies. The first three chapters give a general survey of the physical and biological relations of the continent and of the early and later ethnic and historical relations. From 50 to 100 pages are then given to the discussion of each of the republics illustrated by fine coloured maps and excellent photographs.

So large a topic must necessarily be much condensed, but a great deal more than the essence of things is presented and the series to which this volume belongs is widely recognized as probably the best work in English, both for reading and reference, on the geography of the world. Some small matters are worth revision

in the next reprinting. The spelling Buenos Aires, for example, is used on one or two maps and Buenos Ayres on the others as well as in the letterpress. The official and common spelling is now Buenos Aires.

Guatemala and her People of To-day. By Nevin O. Winter. xii and 307 pp., 49 Illustrations from Photographs, Map and Index. L. C. Page and Co., Boston, 1909. $3.

The fact that before very long we shall be able to travel from New York to the capital of Guatemala by rail will doubtless stimulate our interest in that republic, whose material progress is now important and whose potentialities give promise of a great future. Its people and their customs are described in the present volume and also the land they inhabit, its resources and present state of development. It is evidently a work of careful observation and note-taking, and will doubtless have more readers and provide more entertainment than if it were the product of a trained geographer. The information in the book is reliable and covers something more than Guatemala, as there are also chapters on British Honduras and the Republic of Honduras. The book is handsomely produced in all respects excepting the map, which is very poor.

The Bawenda of the Spelonken (Transvaal). A Contribution towards the Psychology and Folk-Lore of African Peoples. By R. Wessmann. Translated from the German by Leo Weinthal. 154 pp., Map and Photographic Reproductions. *The African World*, London, 1908.

The Bawenda live in the extreme northern Transvaal and the tribe was the last in that country to surrender its independence. They live among the mountains, tilling the fertile valleys. Much attention is now given to their language, which is said to be the key to some other Bantu languages in the interior of Africa. The author lived long among this people as a missionary and, with characteristic German industry and conscientiousness, he wrote this book. We may be glad that it has been translated into English, for it is one of the most thorough and adequate books that has been written on any of the African tribes. There is no division into chapters, but the topics are well arranged and cover the whole field, including the Bawenda family life, arts and industries, social laws, government, superstitions, religion, demonology, witchcraft, folk-lore and racial relations. Now that the Bawenda have come under white governmental control, their home is a land of peace and all may follow their occupations in quietude. Travellers are not now robbed on the highway and the entrances to villages are no longer barricaded. But the new culture has its disadvantages. The author says the white régime is not so severe as their own, and the people are more lax in respect of their own good, social institutions. Neither are they so industrious as formerly, and they are forgetting their native arts, buying, for a little money in the European stores, the utensils which they formerly fabricated. The book brings an important tribe into clear light and its good photographs help the text.

Missionary Story Sketches. Folk-Lore from Africa. By Alexander P. Camphor. 346 pp. and Illustrations. Jennings and Graham, Cincinnati, 1909. $1.50.

Dr. Camphor, a negro, born in Louisiana, who acquired a superior education, was for eleven years president of the College of West Africa at Monrovia, Liberia. He made several journeys into the interior of the republic, collecting at first hand

the material he presents in this book. About 1,000,000 natives are supposed to inhabit the Liberian hinterland, and they are still less known than most of the tribes of the Belgian Congo and German East Africa. Dr. Camphor was long in touch with the native life among the forests and savannas of the interior, and his book makes the largest contribution thus far to our knowledge of these peoples. About 200 pages are given to his travels among them and the information he gathered as to their cultural status and ways of life. In the last third of the book he gives many specimens of their myths and folk-lore and numerous incidents illustrating their social life and the beginnings of religious work among them. The book throughout is infused with the missionary spirit.

Voyage au Thibet par la Mongolie de Pékin aux Indes. Par Comte de Lesdain. 2nd Edition. 346 pp., 29 Illustrations from Photographs and Map. Librairie Plon, Paris, 1908.

A description of the journey which Comte de Lesdain and his wife made, in 1904-5, from Pekin through Mongolia, and central Tibet to Darjeeling, India, where they reached the railroad to Calcutta. The Count did not find it a constant struggle for life, such as some explorers have described, which was especially fortunate, as his young wife was in his party. The natives gave no trouble, not even when he was only a little over 100 miles from Lhasa. Scientific observations were not particularly prominent in his plans, but he was able, nevertheless, to throw a little light on problems relating to the geography of the Mongolian regions of Ordos and Ala-shan; and he crossed the salt desert of Tsaidam and passed the sources of the Yangtse Kiang in Tibet. The book contains many interesting notes on the nature of the regions he visited and of their inhabitants. His map is on too small a scale to serve a wider purpose than to show his route; and though he made many observations for elevations he gives the results only in round numbers. The work is very readable, abounds with adventure, hunting exploits and novel incidents, and tells the story of what is probably the longest journey of a European traveller through the lesser-known parts of Asia accompanied by his wife.

Drugging a Nation. The Story of China and the Opium Curse. By Samuel Merwin. 212 pp., 13 Illustrations and Appendix. Fleming H. Revell Company, New York, 1908. $1.

The chapters were originally published in *Success Magazine.* The graphic story that Mr. Merwin tells is the result of a personal investigation of the conditions of the opium trade in China and its effects upon the nation. India as well as China is involved in the problem, and the author began his study in England and ended it in China. China is now reaping the whirlwind and is eagerly desirous of ridding herself of the curse that has befallen her people. The book describes the predicament in which China is involved, tells of the golden days of the opium trade, gives the facts with regard to the production of the drug and the trade in it, takes the reader to the opium dens of the empire and depicts the great evils that the opium habit is inflicting upon its people. His description of the present attitude of Great Britain does not indicate that that country is trying very hard to help China out of her dilemma. The opium question is one of the great social problems now before the world, and it is not likely to be settled for years to come. In view of the far-reaching interest it has excited, this book will be useful in the study of it.

Ethnological Description of the Amdrup Collection from East Greenland. Comprising Objects found in Eskimo House-ruins and Graves north of Angmagsalik between 68° and 75° Lat. N. By W. Thalbitzer. Reprinted from "Meddelelser om Grönland," Vol. 28, pp. 331–542, 106 Figs. and 16 Plates. Bianco Luno, Copenhagen, 1909.

The ethnographical collection described was made in 1898-1900 by the Carlsberg Fund expedition to East Greenland under the command of Lieut. G. Amdrup. The finds are artifacts from the coast between Angmagsalik, the present northern limit of Eskimo habitation in East Greenland, and Cape Sabine. Some parts of this coast were first visited by the Andrup expedition, and here were discovered the ruins of a number of Eskimo settlements whose inhabitants had died out or had long since deserted them. These places were subjected to a thorough investigation for archæological purposes. Only about 500 Eskimos now live on the east coast. The ruins found by the Amdrup and earlier expeditions seem to show that formerly a much larger population lived to the north of the present limit of settlement.

The correspondence between the manufactures found in the ruins of former East Greenland places of settlement and those of West Greenland seem to indicate that the north-easterly group of natives belonged to the same mother tribe as that from which the north-west Greenlanders, in the Danish domain (Upernivik, Omanak and Disco Island), derive their descent. But the author says that the time when they lived together and exerted an influence upon one another must be very far in the past.

The work describes, in detail, the objects found, many of which are finely shown in the illustrations. The book is a valuable contribution to our knowledge of East Greenland ethnology.

Urgeschichte des Europäers von der Menschwerdung bis zum Anbruch der Geschichte. Von Dr. Robert Forrer. vii and 584 pp., over 1,500 Illustrations and Index. Verlag von W. Spemann, Stuttgart, 1909. M. 6.

One of the latest volumes in the series of "Spemanns Compendien." The diligent and learned author has compiled it from his encyclopedic work "Real-lexikon der prähistorischen, klassischen und frühchristlichen Altertümer." He has brought together, in comparatively small compass, an immense array of discovered facts and objects throwing light upon prehistoric man in Europe, with clear and concise elucidation of the topic in the text and such wealth of well-produced illustration as is rarely seen in a small book. The subject is unfolded from first to last practically all the important explorations of the past ten years being included in the volume. We find here even description and comments relating to the already famous discovery of prehistoric remains at Le Moustier made by Hauser and Klaatsch in the summer of 1908. The book will have a great many friends; and a translation of it into English, as probably the most thorough compendium of a great subject yet produced in small compass, would be heartily welcomed.

Paläogeographie (Geologische Geschichte der Meere und Festländer). Von Dr. Franz Kossmat. 136 pp. and 6 Maps. G. J. Göschen'sche Verlagshandlung, Leipzig, 1908. 80 pf.

One of the excellent small volumes in the "Sammlung Göschen." The publisher is now printing in each volume a classified list of the works that have appeared in the collection, and this will be convenient to students. The book is a

summarization of the results of research showing the classification and distribution of the fossil-bearing rocks. Each of the formations from Cambrian to Pleistocene, is discussed in turn as to the distribution of the rocks, their extent in the several continents and oceans, and most of the chapters conclude with summaries or comments. The six maps show the distribution of land and sea in Silurian, Devonian, Carboniferous, Triassic, Cretaceous and Early Tertiary times.

Kleine illustrierte Geschichte des Vesuvs unter besonderer Berücksichtigung seiner Tätigkeit in den letzten zehn Jahren. Von O. Foerster. 100 pp., Illustrations and Map. Verlag Otto Foerster, Neapel, 1908. 20 pf.

A carefully condensed account of the history of the eruptions of Vesuvius to and including its last great outburst in 1906. Six of the pictures are reproduced from the Lembo Collection, showing the appearance of the volcano, according to the artists of the time, in the eruptions of the years 79, 203, 1631, 1779, 1850 and 1858 A.D. A large number of photographs show the volcano, its lava flows, and the destruction wrought in eruption from 1872 to 1906. A table of the heights of the mountain from 1749 shows that the greatest measured height was 1335 meters in 1901 and in 1906 before the outburst of that year, and the lowest heights were 1070 meters in 1752 and 1794, and 1064 meters in 1822. The height after the eruption of 1906 was 1103 meters, measured from the lowest point of the crater lip on the east side.

Canada et Canadiens. By Dr. Adrien Loir, Prof. in the Faculty of Medicine of Montreal. 372 pp. E. Guilmoto, Paris, 1908.

The title of this interesting little volume should read "The Canadians and Canada," for it is the people and not the country that occupy the bulk of the text. That text is written in plain, terse and solid French, with few attempts at ornamentation, and it shows how very well the French language reads when used in a plain, unostentatious manner, but with a thorough knowledge of French grammar and syntax. The book embraces the British possessions from the Atlantic to the Pacific and from the boundary line of the United States almost to the Arctic Circle. More attention is paid to descriptions of nature in the Western than in the Eastern provinces, the former being much less known in France, than Lower Canada or the former French colony. There are few statistics, and what is said of the natural products of the country may be found in almost any reasonably detailed geographical handbook embracing North America. While treating of the inhabitants, Dr. Loir naturally dwells on the climate as a physician who has to do with some of the diseases peculiar to the country. These notes, while brief, are far from unimportant in a geographical sense, for Dr. Loir stands well in his profession and investigates questions of hygiene and pathological matters wth the trained mind of the European physician who is not merely a specialist. Many of his observations on such subjects are presented in the form of authentic episodes and personal incidents which render them more palatable. Illustrations there are none.

The French Canadians naturally claim Dr. Loir's chief attention, the English being not infrequently mentioned, chiefly when governmental and administrative matters come into play. The author is naturally desirous of strengthening the bond of relationship of the Canadian French with their mother-country. He treats the subject with great impartiality. He gives full credit to England for its fair and liberal treatment of the French people of Canada in modern times and

emphazises the absolute religious liberty and toleration throughout the British dominion in contrast with the persecutions and oppression practiced by "la France Juive" called Republic. Some concessions, made by the English Government, to the spread and use of the French language are highly eulogized. His picture of the character and mode of life of the French Canadians is not free from strictures upon the latter, and he makes the very just remark that the French Canadians are widely distinct from their relatives in Europe, their ideal being "not the France of Zola, Waldec-Rousseau, Combes and Clemenceau," but the France of the two centuries preceding the Revolution.

In matters of history Dr. Loir is not always fortunate. The source whence he derives the information that George Washington led three campaigns into Canada against the British would, if found, be a remarkable addition to historical bibliography. Happily, such missteps are not frequent in the book. His chapter on the Indians is well intended and conveys the rather entertaining piece of information that the Algonquins are of Malayan-Polynesian origin, hence relatives of the Sandwich-Islanders and of the Tahitians! Dr. Loir furthermore assimilates the Iroquois with the Finns and Turks.. Fray Gregorio Garcia, the learned Dominican, in his most remarkable and critical work from 1607, mentioned such and similar ethnographic exploits without, however, committing himself to any opinion.

In his review of the inhabitants of the British Dominion Dr. Loir could not well ignore the Mormons. He takes to them very kindly, extols their thriftiness, religious tolerance, union and harmony among themselves. His sketch of the History of Mormonism is plain and must be reliable, since it is derived exclusively from Mormon sources. It is evident, however, that he has not thoroughly read the so-called Mormon Bible.

Dr. Loir also discusses the question of Asiatic immigration, and his opinion is that the influx and permanent settlement of Japanese, both in Canada and the United States, harbours a danger for both countries. He gives several abstracts from the Japanese press that may have escaped attention here. At the risk of repeating things already known, we translate here parts of an article from the *Shimbun,* a paper appearing at Yokohama:

> Are the United States in a condition to face a war [with Japan, of course]? Their army is pitiable, and as for their navy, although numerically superior to ours, it suffers from the disadvantage of being, through the configuration of their country, in a measure cut in twain. Besides, the American crews are of the most mediocre quality, being composed of heterogeneous elements without any cohesion. Apart from a few Americans, there are in these crews many negroes, Germans, English, and what is particularly favourable to us, Japanese, some of whom are retired or former officers of the Imperial Marine. Some of us have filtered into the crews of the ironclads themselves; others have not refrained from accepting humble positions on board of the warships, engaging themselves as cooks or boys; one of these is at the Brooklyn Navy Yard and he is a former officer of the Imperial Navy. . . .

A. F. B.

Brief Mention.

Le Terre Polari. A. Faustini. 195 pp., 176 Illustrations, Maps, Bibliography and Index. Instituto Italiano d'Arti Grafiche, Bergamo, 1908. Part 1 tells concisely the story of polar exploration and Part 2 gives some description of the Arctic and Antarctic regions in a cursory and popular way. Ten pages, for example, are given to Greenland and as pictures occupy more than half the space there is little room for details. Not a few of the illustrations will be novel to most readers because they are rare.

The Grenada Handbook, Directory and Almanac for 1909. Compiled by the

Colonial Secretary. 256 pp., and Index. Wyman & Sons, Ltd., London, 1909. Grenada, in the Lesser Antilles, has an area of only about 120 square miles, but its population in 1901, was 63,438 and is increasing, chiefly through the excess of births over deaths, at the rate of about 1,000 a year. The book contains a descriptive and historical sketch of the island and many details as to its flora, fauna, climate, products and industries, with special attention to the chief towns, roads and commerce. Attention is called to its scenic beauty and salubrity and the attractions it offers to tourists.

Norwegian Self-Taught. By C. M. Thimm. Fourth Edition, revised and enlarged by P. Th. Hanssen. 128 pp. E. Marlborough & Co., London, 1909. 2s. 6d. Intended chiefly for those who need to use the spoken tongue but do not wish to give much time to the grammar.

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CANADA.—Map of Manitoba, Saskatchewan and Alberta. Scale, 1:792,000= 12.5 miles to an inch. 4 Sheets. Department of the Interior, James White, Chief Geographer, Ottawa, 1909. The new edition of this excellent map shows the extension of railroads and many new settlements along them, especially in Saskatchewan and Alberta.

CANADA.—Standard Topographical Map of Canada. Scale, 1:250,000=3.95 miles to an inch. (*a*) Ontario, Belleville Sheet. Scale, 1:250,000=3.95 miles to an inch; (*b*) Ontario, English River Sheet. Scale, 1:500,000=7.89 miles to an inch. Dep't of the Interior, James White, Chief Geographer, Ottawa. No date.

NOVA SCOTIA.—Geological Survey Sheets. Scale, 1:63,360=1 mile to an inch. Halifax County: No. 39, Tangier Sheet; 40, Harbour Sheet; 50, Moose River Sheet; 51 and 52, Ship Harbour Sheet; 53, Lawrencetown Sheet; 54, Musquodoboit Harbour Sheet; 68, City of Halifax Sheet; 69, Prospect Sheet. Halifax and Guysborough Counties: 41, Fifteen-mile Stream Sheet. Colchester and Halifax Counties: 49, Upper Musquodoboit Sheet. Halifax, Colchester and Hants Counties: 55, Gay River Sheet. Hants and Halifax Counties: 66, Elmsdale Sheet; 67, Waverley Sheet. Halifax and Lunenburg Counties: 70, Aspotogan Sheet; 71, St. Margaret Bay Sheet. Hants County: 73, Windsor Sheet. Cumberland County: 100 and 101, Apple River Sheet. Geologically coloured, with distribution of economic minerals, mines and quarries and vertical sections on margins.

AFRICA.

EAST AFRICA.—Map showing Uganda District. British East Africa and Northern Part of German East Africa. Scale, 40 miles to an inch. By A. Briesemeister, New York, 1909. The map was prepared to show the regions through which Ex-President Roosevelt's party is travelling.

SAHARA.—Adrar des Ifor'as. Carte dressée par le Lieutenant Cortier. Scale, 1:750,000=11.8 miles to an inch. Illustrates "D'une rive à l'autre du Sahara," Paris, 1908. The first detailed map of the Adrar region which is to the N. E. of the northern bend of the Niger, giving, in colours, the results of the surveys of the Arnaud-Cortier Mission in 1907.

SHARI RIVER BASIN.—Carte du Chari. Scale, 1:2,000,000=31.56 miles to an inch. Dressée par G. Bruel. 19 Sheets. Service géographique des Colonies, Paris, 1905-6. A compilation of the information obtained by French and other

explorers, with regard to the hydrographic system of the Shari River. The map does not include the sources of some of the Shari tributaries rising in the Cameroons, but the eastern and southern sheets show the water parting between the Shari basin and the Nile and Congo systems. Some of the Shari tributaries and a large number of their affluents are unexplored or only partly explored and broken lines therefore represent many hundreds of mils of waterways. Mr. Gentil ordered this assemblage of the known facts concerning the basin, and this official map is the best we have of the large river system. Elevations are sketched in yellow, many heights in meters are given and there is a considerable variety of general information, especially concerning the width and depth of rivers, government posts, trading stations and the distribution of the native population.

ASIA.

CELEBES.—Schetskaart van Midden Celebes. Scale, 1:500,000=7.89 miles to an inch. 2 Sheets. 0° 13′—4° 32′ S. Lat.; 114° 40′—122° 35′ E. Long. Topographische Dienst, Batavia, 1907. The map covers a large part of both the eastern and southern peninsulas of Celebes. It presents much new information and shows that the Dutch military expeditions of recent years did not neglect geographical work. The surveys of the Sarasins and Mr. Kruyt are not included and the mountains are merely indicated.

CHINA.—Map of China, showing Railways, Telegraphs & Treaty Ports. Scale, 1:5,000,000=78.9 miles to an inch. Geographical Section, General Staff, War Office, London, 1908. A useful map, showing in red the railroads open to traffic, under construction and projected. Treaty ports are underlined in red and all names on telegraph lines are telegraph stations. A new edition giving the information up to date is about to be issued.

DUTCH EAST INDIES.—Schetskaart van het Eiland Morotai. Scale, 1:250,000=3.1 miles to an inch. By Lieut. G. J. J. de Jongh. *Tijds.* of the Royal Neth. Geog. Soc. III Ser., Vol. 6, No. 3, Amsterdam, 1909. This island is one of the Moluccas. Illustrates "Morotai" by Lieut. de Jongh.

EAST INDIES ARCHIPELAGO.—Nuova Carta idrografica delle Regioni orientali di Borneo. Scale, 1:1,000,000=15.78 miles to an inch. 4° N.—1° S. Lat.; 114°—119° E. Long. *Boll. della Soc. Geog. Ital.* Ser. IV, Vol. X, No. 5, Rome, 1909. A map in colours illustrating "Trenta Mese a Bornéo" by Prof. Guido Bonarelli. Designed to show the drainage systems. An accompanying black and white sketch map shows the orography of the region.

FEDERATED MALAY STATES.—Map of Negri Sembilan. Scale, 2 miles=an inch. Compiled from the records of the Survey, the Public Works and Railway Departments by W. A. Wallace, Surveyor. Alfred E. Young, Chief Surveyor. Office of the Survey, Taiping, 1907. A good map in colours, based on the trigonometrical survey and showing the topography and all phases of culture.

PHILIPPINE ISLANDS.—Map of the Philippine Islands. Scale, 1:1,115,000=16.76 miles to an inch. Compiled by Caspar W. Hodgson. Drawn and engraved by A. Briesemeister, World Book Company, Yonkers-on-Hudson, N. Y., 1908. This is the best map that has been compiled of the Philippines. It includes the area between 117°—127° E. Long. and 4° 50′—18° 50′ N. Lat., with an inset on the same scale, showing the Babuyan and Batan Islands, north of Luzon. It is thoroughly up to date and includes a large amount of information supplied by the U. S. Coast and Geodetic Survey, Hydrographic Office, and War Department

and the various bureaus of the Philippines government, including the Ethnological Survey and the Bureau of Posts. The best Spanish maps were also used in the compilation, but a comparison of these maps with the present product shows graphically that scientific knowledge of the Philippines has vastly increased since the American occupancy. The spelling of geographical names may be accepted as authoritative, the nomenclature having been revised by a committee composed of T. H. Pardo de Tavera, Dr. N. S. Saleeby, C. E. Conant and E. B. Christie. The provinces are coloured politically and mountain regions are shown in brown wash. There are still opportunities for pioneer exploration as is shown by the large areas, especially in northern and eastern Luzon, Mindoro and Mindanao, that are marked "unexplored." Rivers, railroads, common roads, cables, etc., in black, are all sharply defined and one of the excellent features of the map is the clearness with which all information is presented. The most important steamship routes and some of the soundings of the Coast Survey might have been given with advantage. The map fills a need and will be necessary to all persons and institutions requiring cartographic information of the Philippines as we now know them.

SIBERIA.—Karta Sieviero-Vostochnoï Chasti Karskavo Moria ot Ostrova Vilkickavo do Mysa Michaïlova. [Map of the Northeastern Part of the Kara Sea from Vilkicki Island to Cape Michailof.] Scale, 1:365,400=5.76 miles to an inch. By Lieut. Kolchak. Hydrographic Dep't., Ministry of Marine, St. Petersburg, 1906. Records of astronomical points determined along the coast, many soundings in sajènes (1 sajène=7 feet) and movements of shore ice.

SIBERIA.—Karta Sieviero-Vostochnoï Chasti Karskavo Moria ot Mysa Michailova do Ustiia Reki Taimyry. [Map of the Northeastern Part of the Kara Sea from Cape Michailof to the mouth of the Taimyr River.] Scale, 1:365,400= 5.76 miles to an inch. By Lieut. Kolchak and Mr. Prokofiev. Hydrographic Dep't., Ministry of Marine, St. Petersburg, 1908. Gives geographic coordinates of a large number of points along the coast, many soundings, etc. All shores on the map are said to be uninhabitable. Nordenskiöld Archipelago proved difficult to navigate on account of the ice.

ASIATIC TURKEY.—(*a*) Tiefenkarte des Aral-Sees; (*b*) Spezifisches Gewicht des Wassers an der Oberfläche des Aral-Sees. *Pet. Mitt.,* Vol. 55, No. 4, Gotha, 1909. These maps are reduced from the Russian original (1907) and illustrate a paper "Der Aralsee und sein Gebiet nach den neuesten Forschungen," by Prof. Dr. Alex. Woeikow.

AUSTRALASIA AND POLYNESIA.

QUEENSLAND.—Sketch Map of the Herberton and Chillagoe Gold and Mineral Fields. Scale, 6 miles=1 inch. Compiled under the supervision of W. H. Greenfield. Queensland Geological Survey, Brisbane, 1909. All gold and mineral leases are shown in red, with references to a list of them on the plate.

EUROPE.

THE BALKANS.—Das Plioçäne Flusstal im Süden vom Balkan. Scale, 1:250-000=3.95 miles to an inch. No map net. Von Prof. Dr. J. Cvijic. *Abhandl. der K. K. Geogr. Gesells. in Wien,* Vol. VII, No. 3, 1908. Elevations of valley bottoms and terraces in red and green, brown contours from the Russian Map; 6 symbols for geological data. Illustrates "Das Pliozäne Flusstal im Süden des Balkans," by Prof. Cvijic.

FINLAND.—Karte der Küste des Bottnischen Meerbusens zwischen Tornio und Kokkola. Scale, 3.1 miles to an inch. *Fennia,* Vol. 27, Helsingfors, 1907-1909. Six small maps of the coast showing in colours, the geology and the distribution of vegetation. Illustrates "Über die Vegetation an der Küste des Bottnischen Meerbusens," by I. Leiviskä, and "Über die Küstenbildungen des Bottnischen Meerbusens," by the same Author, in *Fennia,* Vol. 23, 1905-1907.

GERMANY.—Geologische Karte des Hinteren Bregenzer Waldes in den Quellgebieten der Breit-Ach und der Bregenzer-Ach bis südlich zum Lech. Scale, 1:25,000=0.3 mile to an inch. *Mitt.* der Geog. Gesells. in München, Vol. 4, No. 1, Munich, 1909. Ten colours for geological formations, with transparent sheet superimposed. Illustrates paper by Dr. Hugo Mylius.

GERMANY.—Specialkarte der Rhön. Scale, 1:50,000=0.7 mile to an inch. By Prof. Dr. C. Hossfeld. Verlag der Hofbuchdruckerei Eisenach, Eisenach. A fine map both in a scientific and artistic sense. The red contours of elevation are emphasized by tints of green and brown so applied as not to obscure the rivers, towns, roads, distribution of forests and other information. The Rhön mountain chain of central Germany is noted for its traces of extinct volcanoes.

NORWAY.—Topografisk kart over kongeriget Norge. Scale, 1:100,000=1.5 mile to an inch. Sheets: 9. D. Tönsberg, L. 10. Hamaröy, 46. B. Melhus; Kristiania omegn, bl. IV (ny utgave). Scale, 1:25,000=0.39 mile to an inch. Norges Geografiske Opmaaling, Christiania, 1909.

WORLD.

WORLD.—Dispersione primitive della specie umana. Mercator Projec. Illustrates "Le razze umane e le loro probabili affinità," by Prof. G. Bonarelli. *Boll.* Soc. Geog. Ital., Vol. 10, No. 9, Rome, 1909.

PHOTOGRAPHS, LANTERN SLIDES, ETC.

The Society has received from The Diagram Company, West Barnes Lane, New Malden, Surrey, England, the following examples of its coloured geographical lantern slides especially prepared for the class room:

The United States: Political; River Basins. Orographical, without names: New England; Appalachians; Mississippi Delta; United States; the same with names. Africa: General Vegetation; the Congo Basin. Russia: Orographical, no names. Pacific and Atlantic: January Rainfall; July Rainfall; Jan. Winds; July Winds; Jan. Currents; July Currents; Jan. Isotherms; July Isotherms; Jan. Isobars; July Isobars.

The slides of which the above are representative include many phases of political, physical and economic geography and are very helpful and graphic appliances for the systematic study of these subjects. They are very effectively coloured, and, better still, are reliable for class room purposes. In the orographical maps, the land forms are shown by contour lines and well selected gradations of colour. They have been favourably received in the United Kingdom and are to be commended to American teachers.

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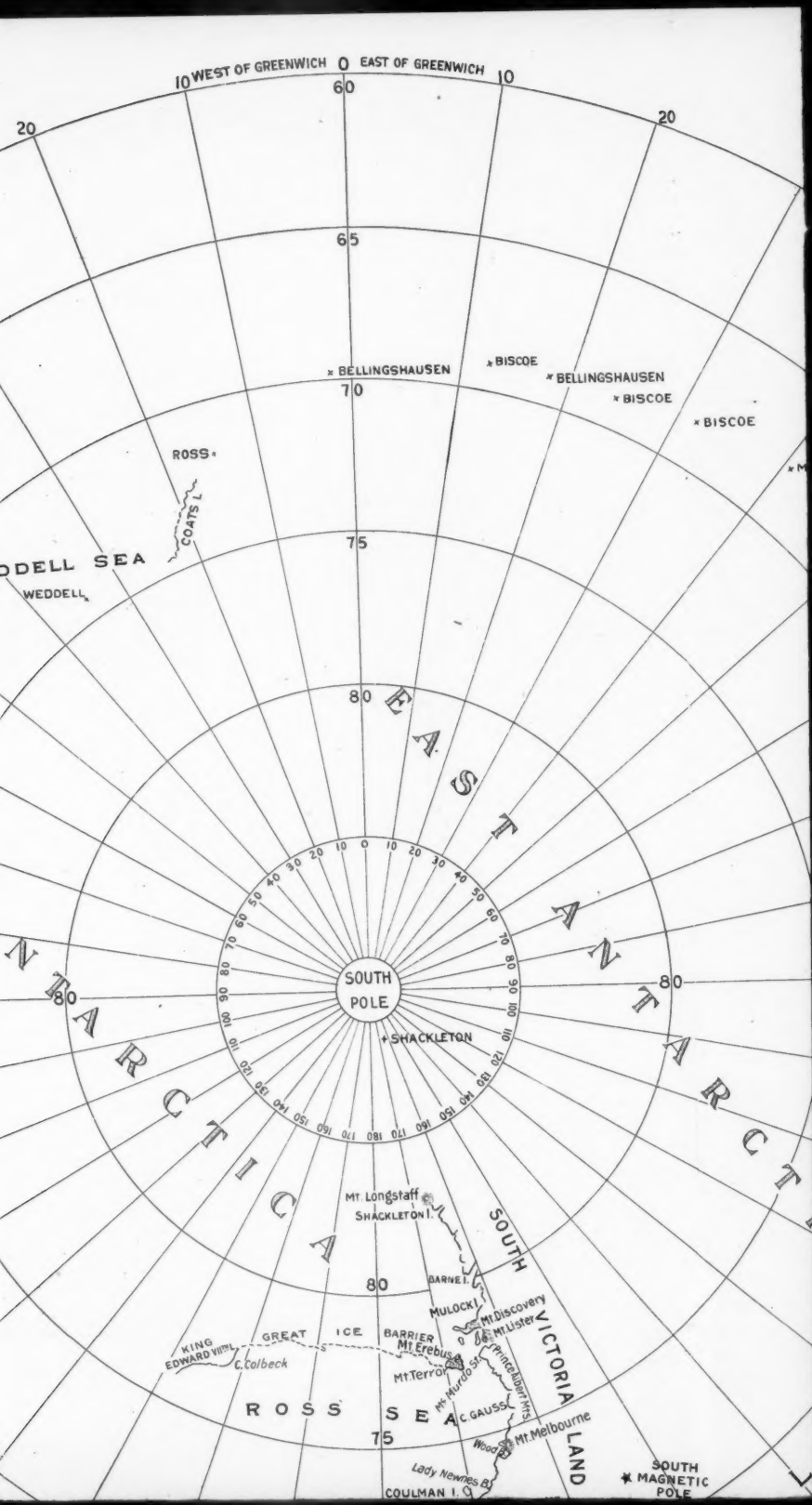
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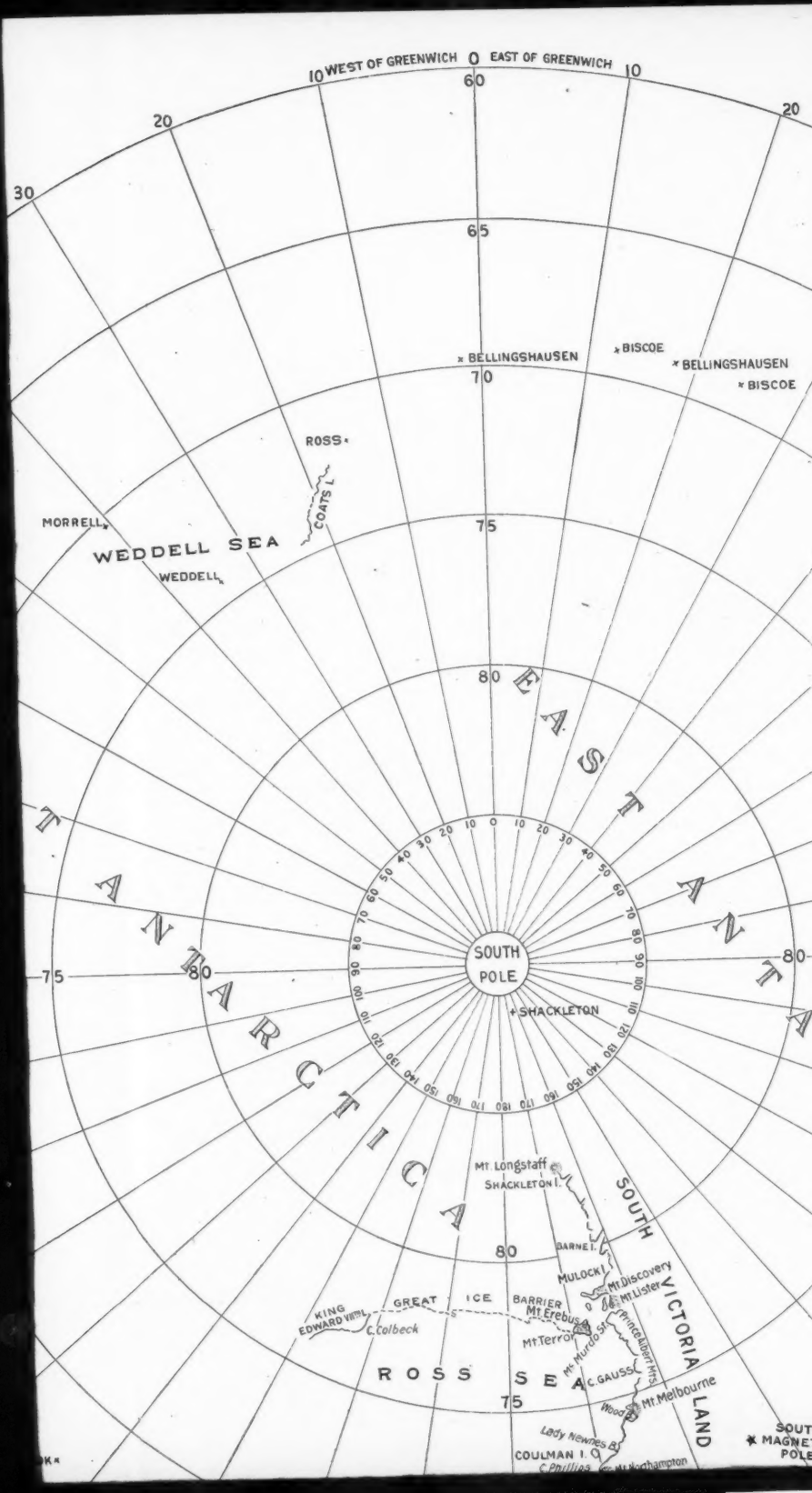
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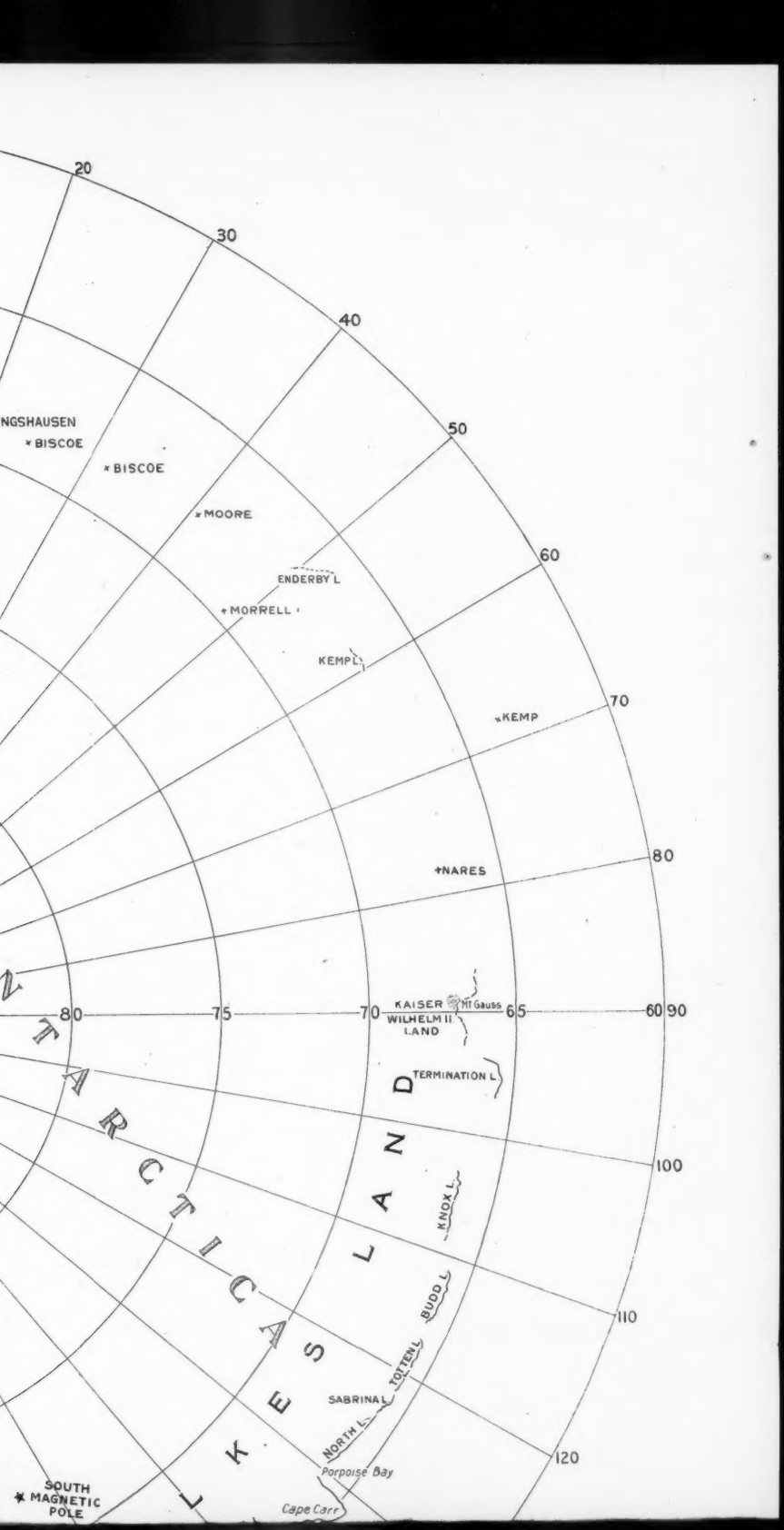
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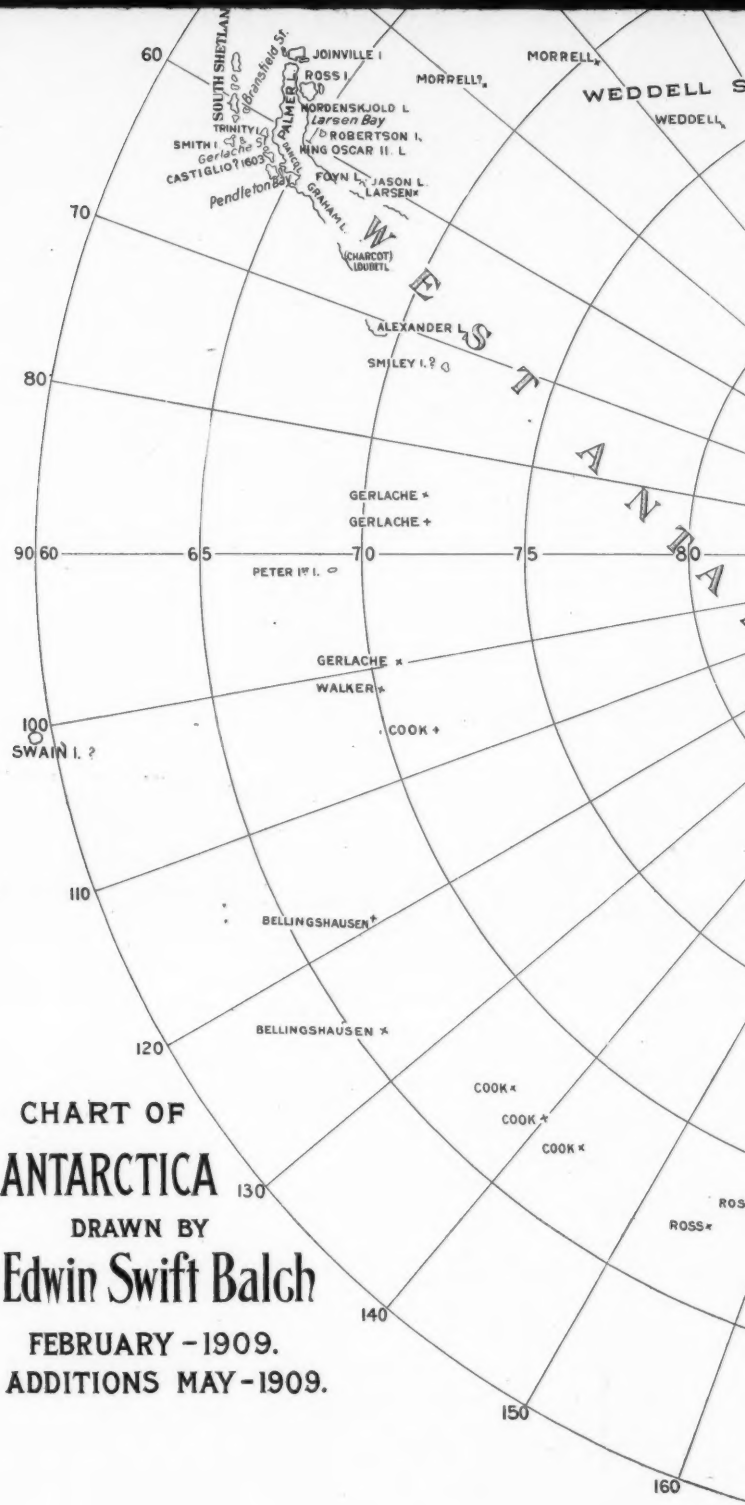

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Edwin Swift Balch
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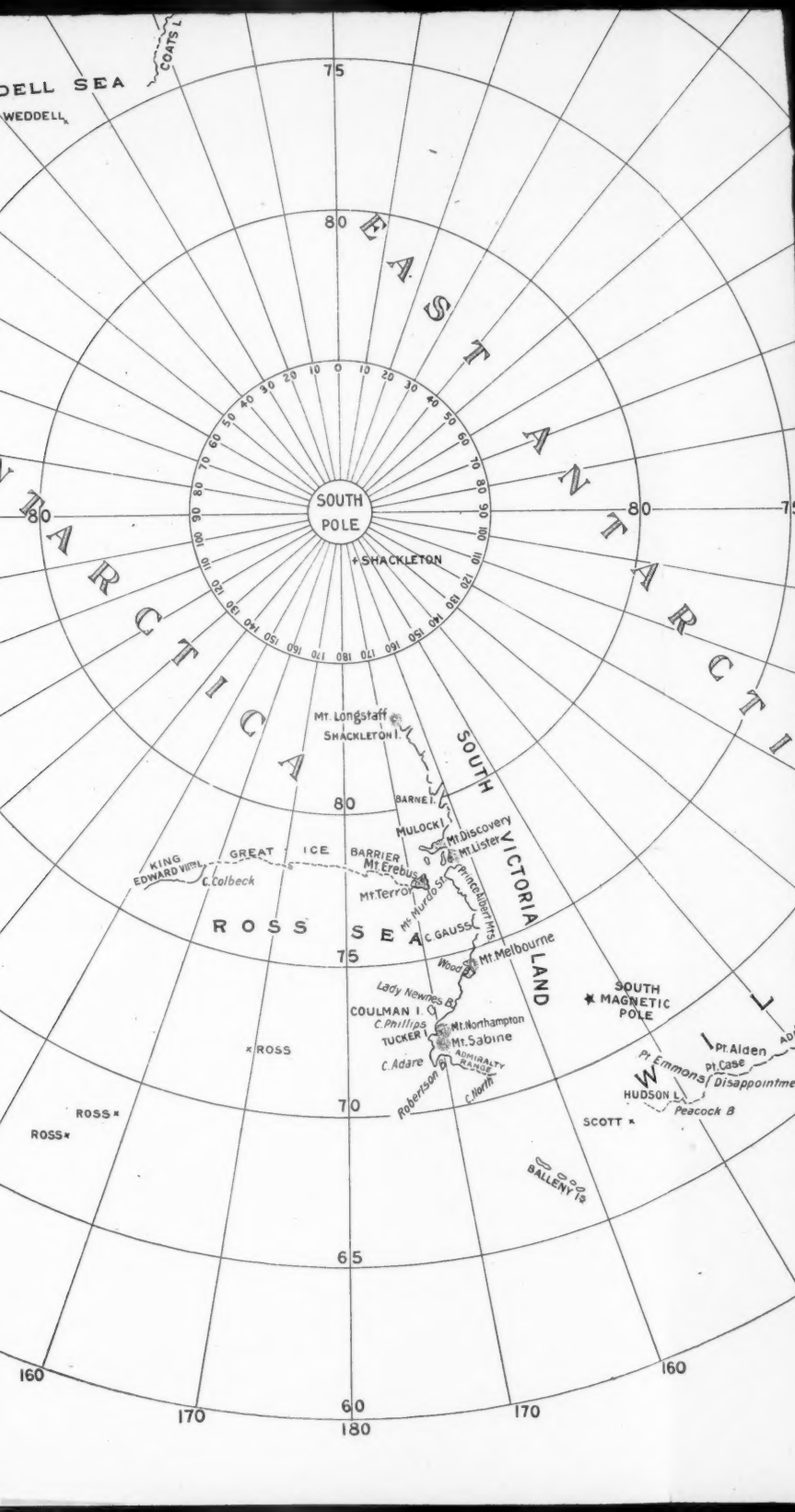
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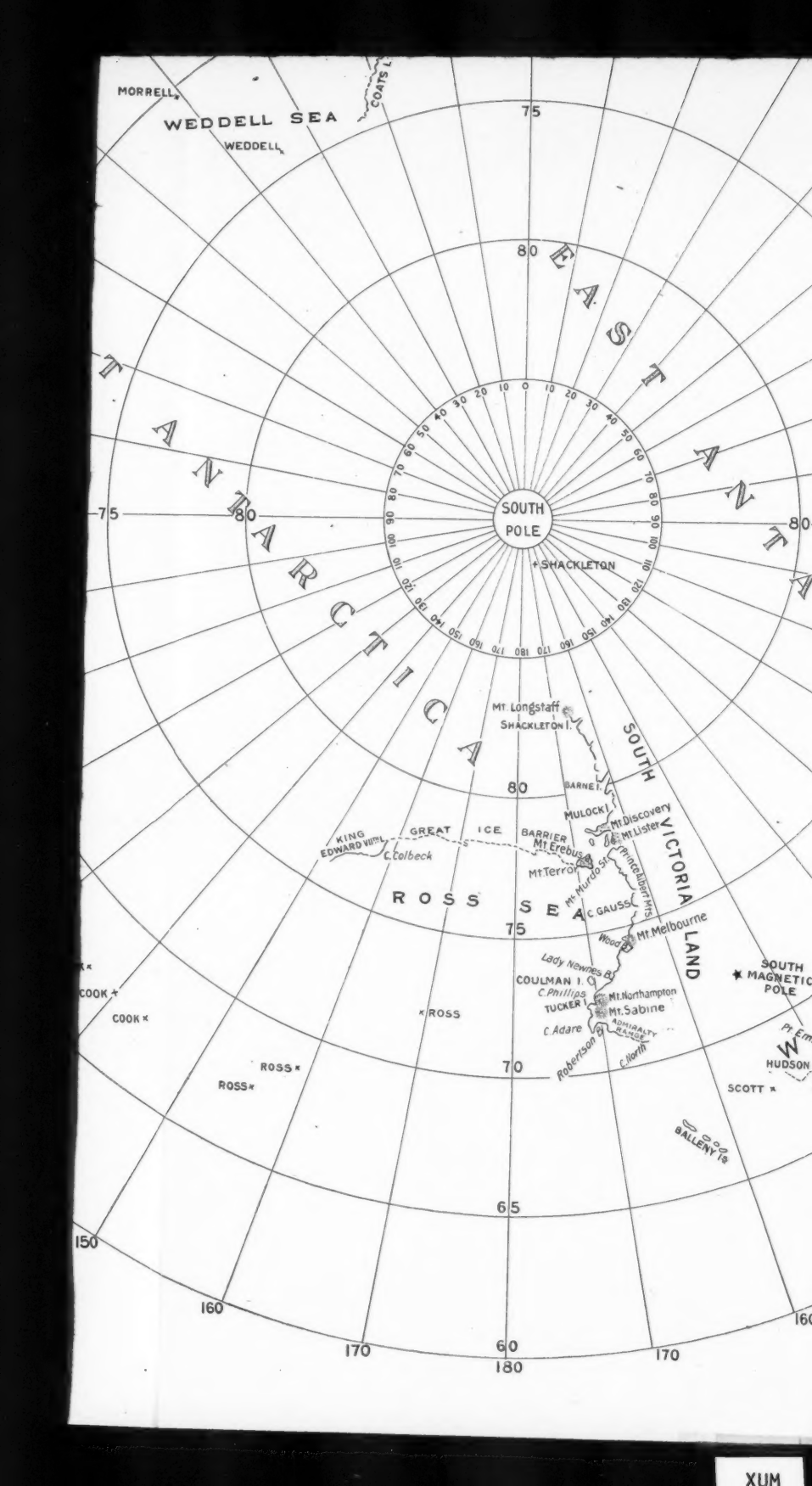
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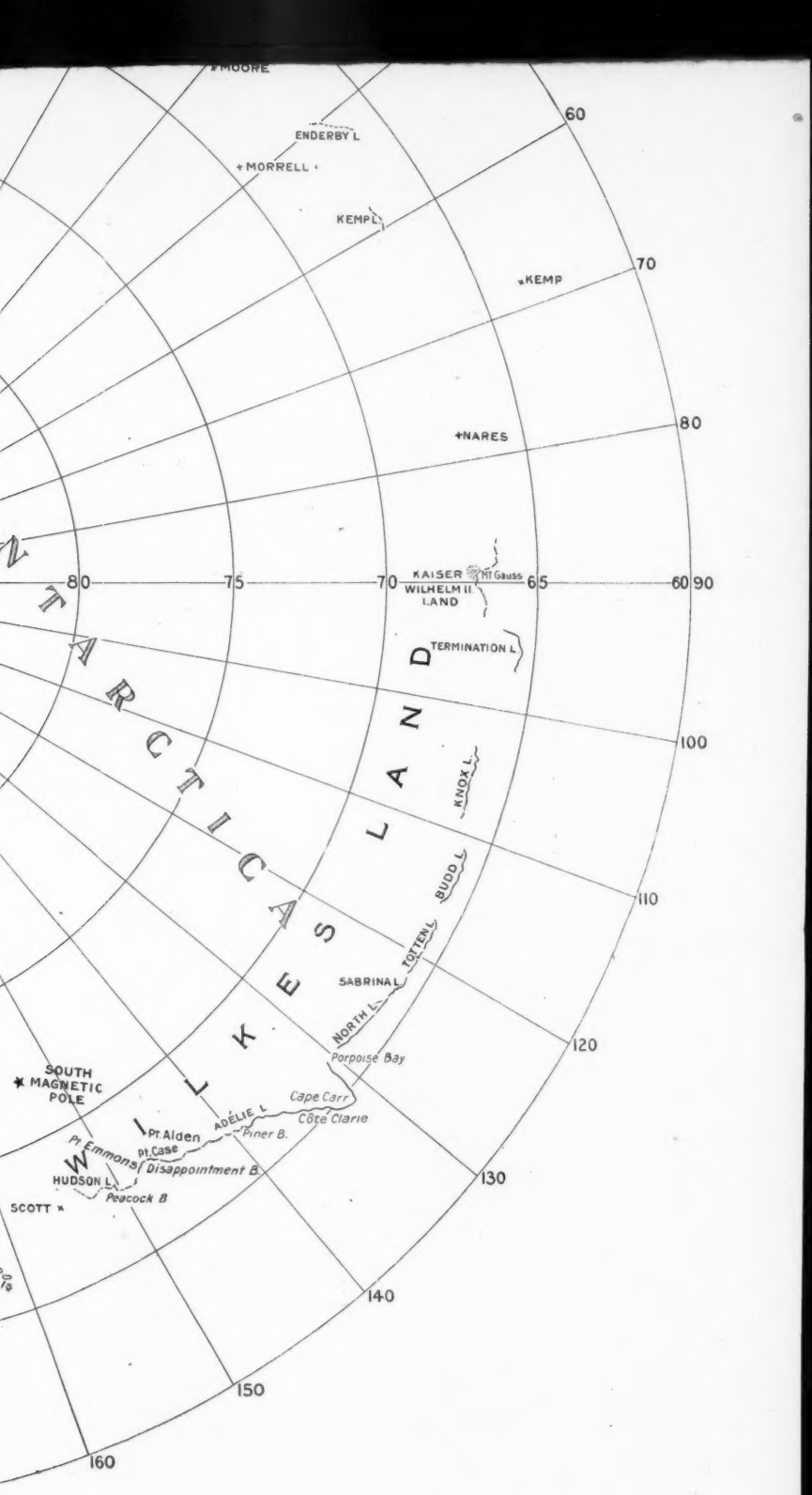
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